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CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
Sixteenth Annual Meeting, Ohio Gas Light Association 321
Wrinkle Department, Western Gas Association 321
EDITORIALS—
Thirtieth Annual Meeting of the New England Association of Gas Engineers 321
Seventh Annual Meeting, Michigan Gas Association 322
Inaugural Address of the President (Mr. Henry O'Connor), on the Occasion of the Last Meeting of the English Society of Engineers 323
The Relative Responsibilities of Engineer and Contractor 327
Experiments with Peat as Fuel 327
*A Combined Exhauster and Blower 328
Pneumatic Engineering 329
A Life Test of Incandescent Electric Lamps, by Mr. Geo. D. Shepardson 330
Special English Correspondence 332
The Lot of the Gas Worker—Coal and Coke—The London Gas Companies.
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 333
Circular from the American Gas Light Association Respecting the International Congress—The Quality of Memphis (Tenn.) Gas—Annual Meeting, Petersburg, Va.—Death of Mr. Jacob Booth—Officers, Syracuse, (N. Y.) Company—Annual Meeting, Waltham, Mass.—Power Plant for Rochester (N.Y.) Company—A Hint from Dalton, Ga.—Annual Meeting, Portsmouth, N. H.—Annual Meeting, Zanesville, Ohio—Cheaper Gas for Fitchburg, Mass.—A Liberal Offer, Bergen County (N. J.) Company—Report Respecting the Alexandria (Va.) City Gas Works—And Other Items.
The Market for Gas Securities 335

[OFFICIAL NOTICE.]

Sixteenth Annual Meeting, Ohio Gas Light Association.

OFFICE OF THE SECRETARY,
DELAWARE, OHIO, Feb. 15, 1900.

The sixteenth annual meeting of the Ohio Gas Light Association will be held at Columbus, Ohio, March 21st and 22d, 1900.

The President, Mr. A. P. Lathrop, of St. Paul, Minn., will call the meeting to order, on Wednesday, March 21st, at 9:30 A.M., in convention hall at the Chittenden Hotel, the headquarters. An address of welcome will be delivered by the Hon. George K. Nash, Governor of Ohio. A response will be made by ex-Governor Asa S. Bushnell, President Springfield Gas Company.

The following papers will be presented:

"By-Product Coke Ovens as a Source of Gas Supply," by Mr. Peter Young, Gas Engineer, Detroit, Mich.

"Street Lighting," by General Andrew Hickenlooper, President Cincinnati (Ohio) Gas Light and Coke Company.

"Prepayment Meters," by Mr. John D. McIlhenny, President Citizens Gas Company, Terre Haute, Ind.

"The Present Status of Fuel Gas," by Mr. John R. Lynn, Supt. Portsmouth (Ohio) Gas Company.

"Gas Appliance Exchanges," by Mr. Fred. R. Persons, Manager Toledo (Ohio) Gas Appliance Exchange.

"Some New Ideas about Oxide Purification," by Mr. B. E. Chollar, Engineer Laclede Gas Company, St. Louis, Mo.

The Question Box, which is always an interesting feature, will be given special consideration. Each member is requested to make contributions for it, and send them to the Secretary not later than March 7th, so that they may be printed.

The gas works, the electric light plant, with a new 685-horse power gas engine, the pipe works and other places of interest will be open to the inspection of the members.

The ladies will be cordially welcomed and cared for.

An opportunity will be given any of the speakers at the meeting to correct their remarks before leaving Columbus, but not after, as all the reports will be turned over to the printers immediately after the adjournment of the meeting.

The Chittenden is conducted on the American plan, and the following rates have been secured for the meeting: $2.50, $3 and $3.50 per day for rooms without bath; $3.50 and $4 per day for rooms with bath. The Chittenden hopes to entertain all of the Association, and will put forth every effort to make the members comfortable. The most satisfactory quarters are always obtained by writing in advance to the hotel people.

The Secretary will furnish with pleasure application blanks for membership, and any further information which may be desired relative to the meeting.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WRINKLE DEPARTMENT WESTERN GAS ASSOCIATION,
OFFICE OF THE EDITOR,
112 NORTH BROAD ST., PHILA., PA., Feb. 16, 1900.

To the Members of the Western Gas Association: The Western Gas Association elected me last year Editor of its Wrinkle Department. The duty of the Editor is the securing (for presentation in convenient form to the Association, at its annual meeting), all possible wrinkles, ideas, devices, suggestions, etc., that during the year have been found by the members to be clever and helpful, in either the construction or operation of a gas works or company.

The success of the Wrinkle Department has been marked. It is looked forward to yearly with interest. *Its success, however, is dependent on the co operation of the members.* Will you not kindly help the success of this feature at this year's meeting by sending me shortly a brief description of any thing or idea that you may have recently noticed, or that occurs to you as suitable for a "wrinkle?" Whether this be something noted by either yourself or your assistants or helpers, in your own works or in those of another, is not material. It is the point itself that is desired, and that each member is asked to kindly contribute, whenever possible.

Drawings necessary to illustrate an idea need not be exact or carefully made, a simple rough sketch will be sufficient, and will be redrawn here if desirable. Your active co-operation in the above will be appreciated by the Association at large, and by the Wrinkle Editor in particular.

Very truly yours,
F. H. SHELTON, Editor.

[Special Editorial Correspondence.]

Thirtieth Annual Meeting of the New England Association of Gas Engineers.

YOUNG'S HOTEL, BOSTON, MASS., Feb. 21, 1900.

Dear JOURNAL: At the hour of writing, an opportunity for which was availed of between the time of adjournment of the first day's sessions and the hour set for the banquet, it certainly looks that the gas men are pretty well in charge of affairs in Young's, for the time being at any rate. The New England Association, which this year witnessed

the close of the third decade of its useful and prosperous life, has so far much to be congratulated upon over its present sessions. The weather was fine, the attendance was good, the officers were alert, the quarters were unassailable, the programme was up to its promise and the interest was sustained. With so much by way of preface, I will, without further interlocution, give you in summary just what occurred. The meeting was called to order with commendable promptness by the President, Mr. Walter R. Addicks, and flanking him was the Secretary and Treasurer, Mr. N. W. Gifford, of New Bedford, who, although serving the Association for the first time in this dual capacity, kept evenly on with the duties thereof in the fashion of one accustomed to such work. The report of the Board of Directors having been received and disposed of, the Association balloted for those proposed for membership, which ballot resulted in the placing on the roll of the names of four active and eight associate members, with one transfer from associate to active membership. The appointment of a committee to nominate officers for the ensuing year was followed by an instruction to the Secretary to send a telegram conveying good wishes to the Michigan Gas Association, in session at Detroit, Mich.—the telegram was "composed" by Mr. C. F. Prichard. The annual reports of the Secretary and Treasurer, and these fully attest the solidity of the Association from a material point of view, having been disposed of, the Secretary read many letters, from as many lights in the gas industry, who regretted that time and circumstance prevented them from sharing personally in the benefits of the meeting. Amongst the letters was one from Mr. T. C. Jones, Secretary of the Ohio Gas Light Association, inviting the New Englanders to be present on the occasion of the Ohio's meeting, at Columbus, next month. The invitation was accepted by formal vote, and the members settled down to a quiet hearing of the inaugural address of President Addicks. As might be expected it was well worth listening to. It covered many subjects, and, as was to be expected, one topic that received much attention was that relating to the operation of the New England Gas and Coke Company, and the latter's twin, the Massachusett's Pipe Line Gas Company. Taken as a whole, the message's references to the twin concerns cannot be said to overpraise them, for I note that one sentence in the comment reads: "I believe that you will be impressed with the fact that as a descriptive title 'The New England Coke Company' would have been more appropriate for this Company to have chosen." None may truthfully deny that the sentiment of the Association was all in favor of the President's characterization. Electrolysis came in for sharp mention, and so did the effect of the competition of gas and electricity for lighting use. But if I keep on with comment on the address, I shall have space for nothing else, so I may take leave of it in the remark that it is brimful of interest and will be read with close attention when the record appears. The address was referred to a committee for consideration and report, following which action committees to make suitable obituary notes on the Association's dead during the year—Hon. W. W. Greenough, first President of the Association; Gustavus E Wetherbee, Supt. Roxbury (Mass.) Company; and Mr. Lyman P. Gerould, of Nantucket, Mass.—were appointed. This brought the regular order to the reading of papers The first considered was that by Mr. Frederick H. Shelton, of Philadelphia, who read a well put together record of "Pumping Gas Five Miles at Twenty Pounds Pressure." Mr. Shelton's chapters induced a lively discussion, in which he fully held his own—this paper and its discussion will look well in print. The next on the list was the paper by Mr. John A. Waters, of Stamford, Conn., entitled "Then, Now and Later." Unfortunately the author was unable to be present at the meeting. The Secretary put its lines before the members, and as a discussion of the paper would be rather tame without its sponsor being in readiness to reply to some of the queries it was likely to bring out, no debate was held. A dip into the Question Box, which had to do with a successful substitute for cast iron gas mains, caused a lively argument and brought the session to the hour for luncheon. The afternoon's proceedings were opened by the election of officers for the ensuing year, the ballot resulting as follows:

President—Walter R. Addicks, Boston, Mass.
First Vice-President—W. A. Learned, Newton, Mass.
Second Vice-President—W. E. McKay, Boston, Mass.
Secretary and Treasurer—N. W. Gifford, New Bedford, Mass.
Directors—Frank S. Richardson, North Adams, Mass.; W. G. Africa, Manchester, N. H.; William McGregor, Pawtucket, R. I.; J. E. Nute, Fall River, Mass.; William H. Snow, Holyoke, Mass.

The fraternal tributes to the memories of the Association's dead having been sorrowfully accepted, the technical proceedings were commenced by the dissection of the topic for discussion entitled "Oven and Retort House Construction and Results." The range of the title was wide, but the discussion was wider as to range and possibility. Chief Engineer Hirt, of the Coke and Pipe Line Company, contributed much to the discussion. Naturally, he confined himself quite closely to that which had been so far done in oven construction and working, as exemplified at Everett, Mass. Others who contributed materially to the rousing debate were: Mr. Fred. Mayer, of Baltimore, who dilated on the merits of the inclined retort system; Mr. Geo. G. Ramsdell, of Phila., who had something of moment to say regarding properly fired horizontal benches, and Messrs. Nettleton, Learned, Coggeshall and Fowler. Next in order was the paper by Mr. N. O. Goulding, of Natick, Mass., whose recital of a "Four Years' Experience with Prepayment Meters" brought out an exceedingly interesting and practical dialogue. A second dip into the Question Box brought the first day's sessions to a close. As I said at the beginning of this letter it, looks that the gas men are dominating Young's Hotel, and everybody is getting ready for the banquet. So far as indications go the affair is likely to be the banner one in the Associations history; and that is saying much.—S.

THURSDAY AFTERNOON, Feb. 22.

Dear JOURNAL: The banquet last night was all that it promised. President Addicks acted as toastmaster, and 100 guests enjoyed the fare of our host and the force of the speeches. Prominent amongst the speakers were President McDonald, of the Western Gas Association; President Ramsdell, of the American Gas Light Association; President Barker, of the Massachusetts Board of Gas and Electric Light Commissioners; Engineer Hirt, of the Massachusetts Pipe Line Company, and Messrs. Dickey, Collins, Nettleton and Shelton. The function was thoroughly enjoyable and harmonious, and at its close all agreed that Mr. Addicks was a pretty good all-round man. As fair as the weather was yesterday so was it unfair to-day. Good, soaking rain, of the real Eastern sort, was our portion; but it did not delay the meeting, which was called on time. The first thing on the programme was the report of the Committee on President's Address, a notable point in connection with which was the recommendation that a committee to keep up with subject of electrolysis be appointed, which recommendation was agreed to.

Then came the discussion on the second topic for discussion, "Under-Water Gas Main Construction." Mr. A. B. Slater, spoke very interestingly in connection with this topic. Another "try" at the Question Box was taken, after which came the paper, by Mr. Benj. J. Allen, of Allston, Mass., on "Some Notes on Oil and Tar Burning." His clear, plain statement elicited a practical exposition of the matter that should result in quite a number of changes in respect of such "burning" in more than one Eastern works. Then a last attack was made upon the Question Box, with a very useful result. Hearty and well deserved votes of thanks, to President Addicks and to Secretary Gifford, were adopted, and the thirtieth sessions of the New England Association were declared at an end. Speaking from an observer's point of view, and as one who attended a great many of its meetings, it is my pleasant task to say that age suits and fits the first Gas Association of the country to the point of causing it to become of greater value to the industry as its years increase.—S.

[Special Editorial Correspondence.]

Seventh Annual Meeting, Michigan Gas Association.

RUSSELL HOUSE, DETROIT, MICH., Feb. 22, 1900.

Dear JOURNAL: That there was a fair attendance of members when, at 10 A.M. of yesterday, President Walker called the seventh annual meeting of the Michigan Gas Association to order, will be understood when I report that 41 members answered to their names. No time was lost in going on with the regular order. The Executive Committee reported in favor of the election to membership of 5 in the active and 2 in the associate class, and named the following papers for reading: "Differential versus Uniform Prices for Gas," by Mr. Sedgwick Dean; "Meter Testing," by Mr. Paul Doty; "Ammonia: Its Saving and Its Concentration," by Mr. George Osius; "The Business End of a Small Gas Works," by Mr. S. Milo Dole. The report having been accepted, a Committee to Nominate Officers having been appointed, and the reports of Secretary and Treasurer Hyde having been indorsed, President Walker read the annual address. It was very well received. The paper by Mr. Dean was then read, and discussed at length. This debate closed the morning session. The afternoon session was opened by the reading of the paper, by Mr. George Osius. It was listened to with attention and debated with vigor. The last number on the programme for the afternoon was the paper by Mr. Paul Doty, whose clever setting out of "Meter Testing" brought forth much comment in the shape of discussion. No one could find fault with the way in which the members of the Association have been entertained. Features of the social side were a theatre party last night and a sparkling luncheon at the Russell House. The proceedings were continued by the reading of the paper by Mr. S. Milo Dole. The election of officers resulted as follows:

President—H. H. Hyde, Racine, Wis.
Vice-President—Paul Doty, Grand Rapids, Mich.
Secretary and Treasurer—H. W. Douglas, Ann Arbor, Mich.

Grand Rapids was named as the next place for meeting. A committee composed of Messrs. H. D. Walbridge, J. T. Lynn, Paul Doty, H. W. Douglas and W. M. Eaton, was appointed to secure contributions to a fund to maintain a scholarship in the University of Michigan, to be known as the "Gas Engineering Scholarship." The Association voted to subscribe $100 towards it. Votes of thanks to the retiring officers, to the Detroit City Gas Company and the Detroit Stove Works, for services rendered and courtesies extended, were adopted and the meeting was declared adjourned. After adjournment the members inspected the local gas works and the handsome plant of the Detroit Stove Works, and both inspections were mines of information and pleasure. The meeting was in every sense a success.—C.

Inaugural Address of the President (Mr. Henry O'Connor), on the Occasion of the Last Meeting of the English Society of Engineers.[1]

And now, gentlemen, I venture to crave your indulgence while I direct your attention to one or two matters of a technical nature. In seeking to find a subject for some observations in this direction, I have felt that I could not do better than follow the unwritten law on such occasions, and confine myself almost entirely to that branch of our common profession with which I am most familiarly acquainted. The business of gas engineering is one in which, as in most similar directions, great developments have been made in recent years.

Looking back over our records, I was somewhat astonished to find that, although the proportion of our members specially interested in gas engineering matters is at present about 10 per cent., and was, I believe, even greater in the past, yet during 46 years we have only had 17 papers, bearing on such subjects. The following list will show that while in these papers many important points were discussed, there are other interesting topics which have never before been brought forward.

The first paper was on "Gas Meters and Pressure Gauges," by Mr. J. Willcock, in 1860; followed by "The Manufacture of Coal Gas," by Mr. A F. Wilson, in 1864; "Modern Gas Works at Home and Abroad," by Mr. H. Gow, in 1868; "The Prevention of Leakage in Gas and Water Mains," by Mr. C. M. Barker, 1869; "The Methods Employed in the Determination of the Commercial Value and Purity of Coal Gas," by Mr. F. W. Hartley, 1869; "Apparatus Employed for Illumination with Coal Gas," by Mr. W. Sugg, in 1869; three papers on "Charging and Drawing Machinery for Coal Gas," by Mr. J. Somerville, in 1873, Mr. F. W. Hartley in 1875, and by myself in 1891; two papers on "Gas Engines," by Mr. C. Gandon, in 1881, and by Mr. S. Griffin, in 1889; "Illumination by Means of Compressed Gas," by Mr. Perry F. Nursey, 1881; "Modern Improvements in the Manufacture of Coal Gas," by Mr. R. P. Spice, 1886; "Gas Substitutes," by Professon Vivian B. Lewes, 1893; "Gasholder Construction," by Mr. E. Lloyd Pease, 1894; "Automatic Gas Station Governors," by myself, in 1897; and "Gas Works Machinery," by Mr. E. A. Harman, in 1898.

Several gentlemen intimately connected with the gas interest have occupied the chair of the Society, but the unwritten law already mentioned not having by that time come into use, Mr. C. Gandon did not confine himself to the review of his own side of the profession, but noted the general achievements of engineering during the year preceding his election. Mr. William A. Valon confined his remarks to another branch of his work—viz., water and sanitary engineering. Another gas engineer, Mr. C. C. Carpenter, who would in the ordinary course have been our President a few years back, found his increasing duties so onerous that he could not afford the time necessary for the presidential work of the Society. Under these circumstances, I feel that a review of the improvements in the methods of manufacture, and in the various engineering work carried out in this branch of our profession, will not be out of place. That a vast amount of work has been done in this way is beyond question. The greatly increasing size of the gas works necessary to supply our cities with gas has demanded considerable engineering ability on the part of those engaged in their erection and superintendence—a demand which has resulted in the growth of a distinctly new class of engineers with specialist qualifications in this branch of the profession.

The staple, raw material in gas making is coal; and one naturally begins with the reception and housing of that article. The mechanical unloading of coals from ships and barges has recently engaged the attention of many engineers; and one of the systems which has now been largely adopted is the use of Hone's patent grabs, which work with a single chain. These are lowered into the hold on to the coals, and then, on the hauling in of the chain to which they are hung, the grabs gradually close, filling themselves with coal as they do so. The rate at which these automatic grabs can unload a ship, when used with hydraulic derricking cranes, has been proved at Beckton to be a little over 50 tons per hour. This speaks exceedingly well for the arrangement, as it clearly shows that, while with the grabs the number of men required is considerably less, the speed is maintained.

About 100 of these grabs are now in use at various gas works in London alone. At several of the works of the Gas Light and Coke Company there are pillars of brick and iron work round which the coal is deposited from the trucks as received, and afterwards lifted by the hydraulic cranes on the tops of the pillars, by means of these grabs, and placed in the smaller trucks running into the retort houses, as the coal may be required. Mr. George Livesey was undoubtedly the first to adopt continuous conveyors on a scale of any magnitude, at the Old Kent Road works, where he installed plant capable of dealing with the coke from 8 ranges of through retorts to the coke breaker, yard, or store; and since then (1890) many others have adopted the system, both for carrying away the coke and for bringing the coal to the stores or retort houses. Where sufficient coal is required, perhaps the simplest and most efficient plan is to provide overhead railways into the coal stores and retort houses, with self emptying trucks drawn by locomotives. Where smaller quantities, however, have to be dealt with, the continuous conveyor has many advantages.

After the storing of the coals, we come naturally to the heating of the retorts. The principles of regenerative firing are becoming every year better understood; and the very elaborate arrangements, which Siemens, Klonné, and others introduced some years back, are giving place to more simple methods, which appear to give equal, if not greater, satisfaction. The intricate channels for the heating of the air supplies have been found unnecessary, and simple settings built with ordinary tiles and firebricks are now being used in most of the larger works; though in moderate sized works some of the patented systems, notably Mr. Hislop's, have been largely adopted, and with considerable advantage. With the exercise of a little care, a large saving will be effected in the fuel necessary for carbonization; but to get the best results, those in charge should be thoroughly acquainted with the underlying principles of the process. A knowledge also of the methods of testing the gases in the furnace or producer, the combustion chamber, and the flues, will enable the engineer to accurately adjust the quantities of air, both for the primary and secondary supplies.

The system of sloping retorts was re-introduced, in 1889, by M. Coze, of Rheims; and these have been very considerably adopted in this country. M. Coze, although not the original inventor of sloping retorts, was the first to make their use practical, and he deserves every credit for his labors. The varying nature, however, of the coals to be dealt with in British gas works has prevented the more general adoption of retort benches on this system. The difference in the angle of repose of the various classes of coal is the great trouble, causing as it does much difficulty in getting an even layer and in effecting the easy removal of the coke, especially when the retorts are cracked and uneven. However, there are a large number of works where the charging and drawing of such retorts goes on daily with much success; and a large new works in the North is to be fitted with them. One suggestion, which I feel never received a sufficient trial, was that proposed by Mr. G. C. Trewby, by which a plate was inserted over the coals while they were being put into the retorts, and prevented their sliding down when the retort was set at as high an angle as 35°; this high angle rendering the removal of the coke an easy matter.

Stoking machinery has been increasingly employed during recent years in order to do away with much of the more arduous labor in the retort house, and at present there are two firms who stand pre-eminent for their apparatus—Messrs. Arrol, who manufacture the Arrol-Foulis hydraulic machinery, and West's Gas Improvement Company, who make Mr. West's machines, which can be driven either by rope gearing, compressed air, or manual labor. Both these systems give admirable results, and considerably reduce the amount of labor required in the filling and emptying of the retorts. In each case the designer of the plant is a gas engineer of considerable experience, who has brought that experience to bear in producing a machine which requires very particular care in its arrangement, as it is subjected to the cutting influence of the coal and coke dust, which has such a very deteriorating effect on all machinery.

For many years past, considerable expense has been incurred, etc., in providing baths, with hot and cold water supplies, for the use of the stokers; but it has been found that they are not used to that extent it was hoped might have been the case, and they speedily get dirty and uncared for. A recent application of a simple shower or shower and spray fitting for this purpose seems likely to meet a better fate, as there is a constantly descending stream of clean water, which, as it fulfils its purpose, goes at once to the drains instead of forming an accumulation of dirty water around the bather.

Coke, the bye-product of the retort, is now largely used for heating, both for commercial and domestic purposes. The public are beginning to find out what scientific men have known for a long time—that its heating power is very nearly as great as that of coal, being, when properly used, in the proportion of about 13,500 to 14,709; these figures representing the number of heat units evolved by a pound of each substance. Coke breeze, which at one time was almost a drug in the market, is

1. *Journal of Gas Lighting.*

now used in so many ways that its price is well upheld. With forced draught it can be easily employed for steam raising, and, mixed with sand and cement, forms admirable concrete. The mechanical breaking of coke has largely developed its use for domestic purposes, the loss of weight in the coke being not more than 5 per cent. with the best breakers, and, as I have already said, the residue (breeze) finds a ready sale.

Although not strictly bearing upon engineering, the question of the recovery of the cyanogen, which is always made in a gas works, could hardly be left out of a list of the improvements made in the methods of manufacture of gas. The cyanogen, which is a gaseous compound of nitrogen and carbon, is produced at the later periods of the carbonization of the charge of coal, and is now principally valuable for export purposes in connection with the recovery of gold from its ores, when it is employed as cyanide of potassium. The amount recoverable from a ton of coal varies from 5,000 grains at low heats to 10,000 grains at high heats.

The methods generally adopted for its removal from gas are:

1. By treatment of the gas, as it leaves the scrubbers, when all the ammonia has been removed, the gas is then passed through soda or potash in solution in the presence of an excess of iron salt, when from 4 to 4½ pounds of crystallized ferrocyanide of soda or potash is recoverable from 1 ton of coal carbonized. The great thing to be noted for the complete recovery is that a prolonged and intimate contact between the gas and the alkaline iron solution is necessary. At one time, the formation of sulphocyanide was considered undesirable, but means have now been devised for rendering this equally useful.
2. By the treatment of the gas liquor with iron salts, when the cyanogen is precipitated as Prussian blue.
3. By the use of oxide of iron in the first purifier for its removal. This plan has been considerably adopted on the Continent, but has the disadvantage of not recovering so much cyanogen as by the washing process, the latter exceeding the former by nearly 50 per cent. Where the recovery takes place in the purifiers, all ammonia must first be removed and a long contact secured with the oxide in a moist state and a low temperature. A further trouble is that the continuous revivification of the oxide reduces the quantity of cyanogen that it will remove.

Weldon Mud is the name of a bye-product from the manufacture of bleaching powder, and consists principally of hydrated oxides of manganese (MnO_2 and MnO) and of calcium. The advantages of this material for removing sulphuretted hydrogen are considerable. Instead of charging purifiers frequently, as is the case with oxide of iron, a small quantity of air is admitted into the vessels, which oxidizes the material and renders charging much less frequent. The Weldon Mud is used until it contains from 50 to 60 per cent. of free sulphur, and might even be used still further; but this extent is generally considered to be the highest that is profitable. The *crux* of the question, as between Weldon Mud and oxide of iron, is purely a matter of the price at which the two materials can be obtained.

While upon the question of the use of bye-products of other manufactures for the purification of gas, a precipitated oxide of iron may be mentioned which has been introduced of late years. It contains 95 per cent. of pure hydrated oxide of iron, and can either be used to assist spent oxide, or mixed with sawdust, coke or any other inert and porous material. As sent out it is in a very fine powder, and can be worked up in the usual way to from 60 to 70 per cent. of sulphur. When such material has to be sent abroad, the saving in freight, as compared with bog ore, must be considerable.

The use of oxygen for the revivification of the oxide or Weldon Mud in the purifiers was, perhaps, rendered commercially possible by the introduction of the Brin process of extracting the oxygen from the air. Our esteemed Past-President, Mr. William A. Valon, was early in the field; and to him is largely due the rendering useful of this plan. He it was who carried out the earliest experiments at the Ramsgate works; and there he proved its utility. He has recently informed me that he is still using this process, and is still as much in favor of it as ever. There is no doubt that the use of pure oxygen has many advantages over the employment of atmospheric air, containing as the latter does such a large proportion of nitrogen, which is only a diluent, and serves no useful purpose when mixed with the gas.

One of the greatest helps to a scientific knowledge of the strains, etc., governing the design of gasholders, was the publication in the *Journal of Gas Lighting*, and afterwards in book form, by Mr. F. Southwell Cripps, of his "Notes on the Guide Framing of Gasholders." This book has done more for the engineering of these structures than perhaps anything else, and has led many to take an intelligent interest in the principles of gasholder construction who would otherwise have been content to plod on in the old rule of-thumb style which generally prevailed before this book appeared.

The gigantic gasholders on the cantilever system which Mr. George Livesey was, perhaps, the first to undertake, have necessitated a much more thorough knowledge of the stresses involved; and to him and Mr. Cripps no little thanks are due from the gas engineering profession for their aids to this knowledge. The articles by the latter gentleman were originally intended as a criticism on the proposal for the abolition of guide framing first suggested by Mr. Webber. It is probably this fact which has prevented many from following as closely as they might the admirable chapters on the designing of the more ordinary types of gasholders with cast iron columns and wrought iron or steel standards. If Mr. Cripps could be induced to publish a small pamphlet giving merely the details of his investigations into these more everyday strains, I feel sure he would not only earn the gratitude of his professional brethren, but would reap the reward in other and perhaps more solid ways. In the year 1899, which seems to have been very fruitful of new ideas and processes, columnless gasholders were first suggested in a practical form, either with spiral guides, or with wire ropes to keep the floating bell horizontal. Both these systems have been adopted in a considerable number of works, and appear to have given every satisfaction. They have certainly shown that the heavy and costly guide framing, which was in past years considered necessary, can be largely done away with, and that without endangering the safety of the structure. Although personally interested in the rope system of guiding, having taken out a patent for this method some three months only after Mr. Pease, I am fain to confess that for large holders I do not care to advocate the abolition of all guide framing, but much prefer Mr. Livesey's plan of retaining the framing to a certain height, leaving only the upper portion free or guided by wire ropes. That this is quite feasible has been proved by Mr. Livesey's gigantic example at East Greenwich.

Gasholder tanks have, of course, like the gasholders, assumed much larger dimensions, and in connection with their size, considerable changes have been made in the material of which they are made. The old-time brick tank with puddled backing has now largely given place to the concrete tank, either with puddled backing, or, what is more common, the face rendered with nearly neat cement. The saving in cost is very considerable, and the tightness and durability are not in any way impaired. One of our Past-Presidents, Mr. C. Gandon, in making a concrete tank somewhat recently, conceived the idea of casting blocks of concrete from time to time. Whenever he removed any old retort work, and had sufficient broken fire brick, etc., he cast blocks of the right shape to form part of the wall of a proposed tank, so that when the tank was started, a number of these blocks were ready to be merely jointed together in position. This plan has many advantages, as it saves ground space which would otherwise have to be provided for the storage of the broken bricks, and it certainly helps largely to keep the works tidy. It, however, necessitates the providing of plans of the extensions long before these are absolutely required. I am wondering in how many works this has been done, and a clear and distinct plan of extensions provided, to which the works may be converted as the output increases. I fear in but few except the larger works. Effort in this direction should form an interesting and instructive work for any gas manager, and might well become a source of no little profitable discussion whenever several congregated together.

To return, however, to the use of concrete in gasholder tank construction, I can recommend to any one about to undertake such work the plan adopted by myself in the construction of a 10 feet tank somewhat recently. The concrete was mixed dry on the ground level with only one turning, and then shovelled into the hopper of a shoot leading to the stage at the level where the concrete was to be used. It was then watered and turned over, and was found to be most thoroughly mixed—in fact, I have never seen better mixed concrete than in this instance. The method occasionally adopted of wetting the concrete before it is put into the shoot is one which I cannot recommend, as it has a tendency to coat the sides of the shoot with cement, and leaves the ballast or other aggregate to pass down without the proper amount of cement.

It is unfortunate that little new data or little information of a scientific nature have been forthcoming as to the strength of tank walls, as the old methods of calculation are distinctly unsatisfactory, and until some one with time and inclination to experiment takes the matter in hand, mere rule-of-thumb must continue to largely prevail in these matters.

The recent expiry of the Otto patent for the 4-cycle gas engine, which was first introduced in 1876, has led to a number of makers of such plant including these engines in their manufactures, and there is little doubt that the use of gas engines will increase in consequence. But gas engineers do not sufficiently push their use, nor do they use them sufficiently in their works. In my opinion, all motive power in a gas works, except that for the exhausters, which is so very variable in its load, should be furnished by gas engines. Scrubbers, pumps, coke breakers, elevators, stoking machinery, could all be driven by this means; but how often is it so done? Let the public see that we practice what we preach, and they will the more easily believe us.

Mr. Denny Lane's suggestion was a distinctly good one—viz, to supply current for electric light by means of gas engines; but this has not been sufficiently encouraged. Nor have gas engineers taken this matter in hand, or they could have kept much of the electric lighting within their own power, and with little if any decrease in their gas consumption.

Gas engines are now made on the Continent up to 1,000 and even 1,500-horse power, if desired, and to be used with coal gas, Dowson gas, or high furnace gases; the use of these latter effecting a considerable saving in fuel as compared with their use for heating boilers for steam engines.

While upon the subject of internal combustion engines, I might mention a coal dust burning internal combustion engine of a very novel description, which has been invented by Mr. P. F. Maccallum, of Helensburgh, Dumbartonshire, and experimentally tried on a small scale at Edinburgh. The construction of the engine is such that no lubrication of the combustion cylinder is necessary; while at the same time the rubbing surfaces of the piston and working cylinder are thoroughly protected from heat and dirt by an ingenious method of interior water circulation. In working the experimental engine, a volume of air is compressed by the up-stroke of the piston into the upper part of the combustion cylinder. The proper quantity of coal dust is then injected by a jet of high pressure air on to a wrought iron plate attached by a stud to the piston, and maintained at a high temperature by the successive combustions. Immediately the first portion of the coal dust strikes the plate, ignition takes place, and a working down stroke is made. When the piston reaches the bottom of its stroke, the exhaust valve opens, allowing the combustion products and suspended ash to escape. A fresh charge of air then ascends through automatic valves from the crank chamber, and is compressed into the upper part of the cylinder in readiness for another combustion stroke, and so on. As the fuel never comes into contact with any but dry surfaces, and is always kept in a state of suspension and motion, no accumulation of ash or dirt takes place within the engine; the force of the exhaust being amply sufficient to sweep out any solid matter which can possibly enter the engine through the fuel feeder. The engine is equally satisfactory when employed with oil.

The engine working with coal dust gives diagrams of good and regular form, showing about 15 horse power at a speed of 150 revolutions per minute, with a fuel consumption of about 1½ pounds of coal dust per horse power per hour. The consumption of fuel would be much less but for several defects in the design of the experimental motor—in fact, from one cause and another nearly one-half of the fuel injected at each stroke is exhausted without having done any useful work. Notwithstanding the defects alluded to, inseparable perhaps from a first motor presenting so many points of absolute departure from previous practice, the engine has been pronounced a practical success by many well known experts who have examined it in operation. Professor Stanfield predicts that a larger engine of improved design will give a horse power for a consumption of about ½ pound of coal per hour. Almost any kind of coal can be used, and the cost of pulverizing is stated to be from 12 cents to 18 cents per ton. The inventor is now engaged in forming a company to fully demonstrate his system by building a larger engine on improved lines.

The troubles with the laborers engaged in gas works in 1889—first at Beckton, then at Manchester, and finally at the South Metropolitan Gas Company's works—will be in the memory of most of us, more especially on account of the success of the latter Company, who were afterwards able to announce that they would receive no Union workmen. The strike cost them a considerable sum of money, and was perhaps the direct cause of their profit sharing scheme, which provides a bonus of 1 per cent. on the year's wages of any workmen for every 2 cents reduction below 66 cents per 1,000 cubic feet. This was a successful attempt to identify the workmen with the interests of the Company. At Beckton, however, the Directors of the Gas Light and Coke Company erected, and have kept in order since that time, complete barracks, with officers' quarters, bakeries, etc., in accordance with an arrangement with the War Office that in the event of the stokers leaving, soldiers from the Royal Artillery shall be quartered in the barracks on the gas works, and accompanied by their own officers. Beds, blankets, etc., are dried and aired continually.

Probably the strikers were the cause of one of the most conspicuous instances of evolution in the manufacture of gas—namely, the introduction into this country of the system of carburetted water gas, which had been considerably used in the United States. Originally patented in the year 1842, by Mr. J. H. Ibbetson, it never proved a commercial success until, in 1873, Professor T. S. C. Lowe introduced what is now termed the "Lowe apparatus," which is really the foundation of all the carburetted water gas plants in use in this country. All these plants make use of the well known fact that superheated steam passed through incandescent fuel becomes separated into its component parts, hydrogen and oxygen; the latter combining with the carbon of the fuel to form carbon monoxide, the former passing off by itself. These gases are then enriched by being mixed with oils vaporized by heat, and are further fixed, or rendered permanent, by prolonged contact with heated surfaces.

The fact that the name "carburetted water gas" contains the term "water gas" is unfortunate, as many would-be clever people who have that "little knowledge" which is "a dangerous thing," have been raising considerable agitation in many towns in which this plant is being placed. The one fact which they have failed to grasp is that, while water gas, *per se*, has no smell, carburetted water gas has, if possible, a stronger and more penetrating smell than coal gas; and yet, day after day, we see the statement advanced in the press that the danger of the adoption of this system of gas supply is the fact of its possessing no smell, while it is of a much more toxic character than ordinary coal gas. The pronouncements of scientific men seem to have no effect on these statements, and one finds them repeated time and again.

That carburetted water gas does contain more carbon monoxide than coal gas is not to be denied; but that the extra quantity which will be delivered through the mains to the consumers will cause any greater number of accidents through escapes, I do not think at all likely. As one eminent scientific gentleman remarked, "Gas is not made for breathing." At the present time, plant to the extent of 97,795,000 cubic feet per day has been erected by Messrs. Humphreys & Glasgow, by the Economical Gas Apparatus Construction Company, and by Messrs. Samuel Cutler & Sons in different gas works in this country. That such a number of those responsible for our gas supply should have favored this system clearly indicates that there must be in it several points of advantage to the gas maker. First and foremost, the small area required is, in some works, the most important consideration; and nearly four times the quantity can be made of carburetted water gas as could be made of coal gas in the same area. The initial cost is comparatively low; while the number of men employed is much less. But what perhaps interests the gas engineer more is that it uses up his stocks of coke and enables him to ask for, and obtain, a much higher price for what he has to spare. Then, again, the rapidity with which a set can be put into complete action is, in our foggy and changeable climate, a great advantage. A completely cold setting can in four hours' time be in full work, as against some forty-eight hours with coal gas retorts. The simplicity also of the regulation of the candle power of the gas by the control of the quantity of oil used in carburetting, is distinctly in favor of the process; while the fact that troubles with naphthaline in the district are much reduced, if not entirely removed, forms yet another reason for its popularity.

The contractors for this apparatus are generally prepared to guarantee that the plant shall produce 1,000 cubic feet of 22 candle gas, with not more than 50 pounds of coke nor more than 4 gallons of oil—and this under very stringent conditions. That the contractors have almost invariably improved considerably upon their guarantee is a clear proof of the satisfactory nature of the various designs for the apparatus. An average of some 24 tests in the same number of works gives a candle power of 22.56, with a quantity of oil of 2.99 gallons per 1,000 cubic feet.

The Peebles process of making permanent high quality gas for enriching ordinary coal gas has been considerably adopted throughout the country. Using, as it does, almost any class of oil, it has, with the water gas plants, distinctly governed the price of cannel coal, and prevented that commodity rising to the high figure it seemed destined to reach. The plant is very simple, and consists mainly of a retort set at a slight angle and heated to from 900° to 950° C., or about black red. The oil is run into the retort and gasified, passing away to condensers filled with the oil making its way to the retort. The washing with oil

removes all the non-permanent gas, so that only the gas which will remain as such passes away to the mains, while that which has been condensed out by the oil is returned to the retort with the fresh oil, and is there either gasified into permanent gas or else left in the retort in the form of a dense coke, consisting of nearly 96 per cent. pure carbon. It has been found with the gas made by this plant, as well as with that made in the carburetted water gas plants, that the enriching value of the gas is considerably greater than its direct illuminating value would lead one to believe, and this to an extent of from nearly 25 to 30 per cent.

The Clark-Maxim carburetters, and also that of Mr. Cripps, are now largely used in gas works for enriching the gas as it leaves the works; and in them a highly volatile liquid carburine is generally used, although naphtha or benzene are also frequently employed. These systems are said to reduce the number of naphthaline troubles.

A few years back, the discovery of the possibility of manufacturing acetylene gas—which Professor Vivian B. Lewes had been endeavoring to show was the principal cause of the illuminating power of coal gas—from carbide of calcium, led to innumerable patents and reports that a further rival to coal gas had arisen, which would entirely supersede it in a very short while. This, however, it has not done, although it has been considerably introduced for the lighting of private houses in country districts which the ordinary towns' gas mains do not reach. The necessarily high price of carbide of calcium, which requires a fairly strong electric current for its manufacture, has done much to restrict the use of this acetylene gas; while numerous accidents with it, both at home and on the Continent, have made people chary of adopting it. One of the unfortunate circumstances connected with this gas is that it does not hold its high illuminating effect when used as an enricher of lower candle power gases. When it is employed in this way, its enriching value is considerably reduced—far beyond what would generally be the case with other rich gases. It is, therefore, very different in this respect from either carburetted water gas or the gas made by the Peebles process of direct oil gas enrichment. The great simplicity of the making of acetylene gas from calcium carbide will no doubt assist in its adoption; but that many have been grievously disappointed over it can be easily seen by an examination of the Patent Office records.

For some years past, I have devoted a large amount of time to photometrical matters, more especially with the aim of devising a photometer which shall require no calculations of any sort; so that it may be placed in the hands of anyone of ordinary visual activity, but who may not have that acquaintance with decimal arithmetic which is necessary with present methods. A few years ago I read a paper on the subject before the North British Association of Gas Managers, dealing with the progress I had then made in this direction. I have since then had the matter simplified through the introduction by the Metropolitan Gas Referees of their new form of photoped testing apparatus. They have gone largely on the same lines as I was working on, in that they bring the beams of light from the two sources—namely, the standard and the light to be tested—upon one translucent screen. The principle of measuring the time which it takes to consume the one-sixth part of a cubic foot of gas when the two beams of light are equal, has enabled me to arrange for the complete elimination of all calculations. I attach the clock to the meter, and have a connecting rod by which the clock may be started and stopped, when desired, by the meter; and upon the face of the clock I have a second circle divided into candle powers and tenths about the ordinary circle showing the seconds. In making a test with this instrument, the procedure is exactly similar to the Gas Referees' new Instructions, in so far as regards the comparing of the beams of light and the settling of the proper rate of travel of the meter; but the latter, having the attachment for correcting for the variations of temperature and barometrical pressure, removes the necessity of calculations for this correction. As soon as the rate of travel is found, the clock is started by depressing the lever in the ordinary way. This not only starts the clock, but puts into gear a wheel which will have the effect of stopping the clock when the meter has made two revolutions. The position of the hand indicates on the outer circle of the clock the exact candle power of the light being tested. This system could also be applied to the ordinary bar photometer. Any engineer can readily set out such a circle for his clock after an examination of the table provided by the Gas Referees.

With regard to the more chemical part of gas testing, the principles remain much the same—namely, the absorption by different reagents of the several constituent gases, and noting the diminution of the volume of gas after absorption. The Cooper tube or eudiometer has been almost entirely superseded, on account of the great trouble involved in getting perfectly accurate results; and a host of other apparatus have come into use—principally the Bunte burette, the Frankland and Ward, and the Orsat-Muencke apparatus. In the latter arrangement, separate chambers are provided for the absorption by each of the reagents; and the gas is forced into each in turn, the diminution in each case being noted. This is very useful and convenient for the partial analysis of gases, more especially furnace, producer, and flue gases; while the Frankland and Ward apparatus, which is somewhat elaborate, is more suitable for thorough analysis, but is only to be found in very complete gas works laboratories.

Having only recently dealt with the subject of governors in my paper before the Society, I need not enter into great detail regarding the improvements in them. At present, it would hardly be possible to find a governor made without compensation of some kind for the variation in inlet pressures. The principle of working a governor at some distance from the works by means of an air tube and separate loading bell, first proposed by Mr. Foulis, has been adopted in a number of works, and the saving in main laying threby has been great. Several arrangements have been tried, with success, for the purpose of varying automatically the weighing of the bell according to the quantity of gas passing through the governor. The greatest trouble, however, which makers of these pieces of apparatus have to contend with is the desire on the part of most engineers for a governor of much larger capacity than is at all necessary. The area of the cone of the governor need never be greater than two-thirds of the area of the mains in connection with it, and where only a very small day consumption is found, a smaller bye-pass governor may be fixed with advantage.

One of the greatest advances in gas matters has been the introduction of the Welsbach incandescent light. The early attempts were unsuccessful, owing to the tender nature of the mantles, and it was not until the use of collodion was introduced that it became possible to send the mantles from manufacturer to user. The patent for the use of the rare earths employed in the preparation of the mantles was perhaps more carefully drawn up than many others, as, despite most costly litigation, the original patent has been upheld throughout. The first patent has now expired, but there is still another in the hands of the Welsbach Company which has some years to run, and which contains protection for a very essential element in the making of the mantle. Into the details of the manufacture I need not enter; but a remark may well be made on the enormous increase of light obtainable by the incandescent system over the ordinary flat flame or any other form of burner, it giving as much as from 25 to 30 candles per cubic foot of gas as compared with some 3 to 4 candles per foot with argands or flat flame burners. In other words, a Welsbach burner will give a light of 20-candle power for 1,000 hours for 56 cents, while a flat flame burner, for a light of only 16-candle power for 1,000 hours, will cost $3.75.

That this burner has done more for the extension and retention of gas lighting than any other invention of the last 20 years, cannot be denied, as not only is the light much cheaper, but a reduced quantity of gas required means a smaller quantity of oxygen consumed and air vitiated, an important point in small rooms. There is, no doubt, still further improvement necessary, and that is in the direction of strengthening the mandle. Wherever vibration exists, the mantles speedily go to pieces, and hence, despite elaborate mechanism to preserve the mantles, they will still be absent from many of our street lamps, where they would be most admirably placed. This is owing to the large number of mantles completely spoilt in a very short time, and when a stronger mantle can be supplied, there is little doubt that our streets will speedily be better lighted.

The knowledge of the ordinary gasfitter of the elementary principles which govern the distribution of gas is very limited. He seldom knows anything of the difference in pressure due to the varying levels, the difference in quality of the gases in different towns, or the difference in the respective quantities that can be passed through a pipe of a given size and of a certain length according to the variations in the specific gravity of the gas. When called upon to lay pipes and light rooms, he goes by any old rule-of-thumb method which his father or grandfather practised. How many could set out a diagram showing, say, the amount of light thrown upon the floor by the lights they suggest for a certain room? How many know even the most ordinary details of gas manufacture? Surely here is a field for those who have the necessary knowledge to begin by enlightening the gasfitter, and so save trouble later on. Every gas manager in the three kingdoms should give lectures periodically to those in his town interested upon these points, and if he cannot do it himself, some one who has perhaps the time or requisite knowledge should be engaged to give such lectures

in as popular a manner as possible. The addition of a small model gas works, or even the simple old experiment of the clay pipe, will help many to better understand the method of the manufacture. For my own part, I have always found these lectures listened to with interest by all classes of the community.

And now, gentlemen, I think I have said enough to show that a gas engineer at the present day has to be educated in most of the branches of the profession of a civil and mechanical engineer, and to aid him in this direction, much good has been done by courses of lectures in most of the large centers. The admirable reports of the various meetings and the careful selection of interesting matter in our technical journals, the *Journal of Gas Lighting* and the *Gas World*, have also helped considerably; but in addition to these means, the gas engineer must apply himself to the acquirement of knowledge from every possible source. He should make it a rule to note down every item coming to his notice which may at any future time be likely to be of use to him. He must study every detail of the apparatus under his control. He should be able to take to pieces and re-make any portion of the works, however unimportant; it is not sufficient merely to know their use and purpose. He should be able at any point in the process of gas making to make a test both of the gas itself and of the material used in its purification. He should study not only the stresses in the various structures, but should also note the effect of wind, weather and oxidation upon them. If he be sufficiently inventive, he can make for himself, very cheaply, almost all the testing apparatus he may require, provided he understands correctly the principles upon which the tests are made. The examinations annually held by the City and Guilds of London all over the country are most admirably conducted and of a thoroughly practical character. A glance over the questions of the past few years will satisfy anyone that they are not set by mere theorists, but by men with a thoroughly practical every-day experience of the needs of a gas engineer. I would strongly advise all young men connected in any way with gas works to study and to strive to pass these examinations, as they will find that to hold the certificate of the City and Guilds is to have a guarantee of their practical acquaintance with the working of a gas works plant. General knowledge of all branches of engineering may be obtained in few better ways than by attendance at such meetings as ours. For my own part, I cannot recollect the occasion when I have been present at the reading of a paper, and the subsequent discussion, when I have not gone away with some information likely to be of benefit to me, and I hope to see a full attendance each evening during my year of office.

The Relative Responsibilities of Engineer and Contractor.

Engineering Record notes that a suit which has been dragging in the Pennsylvania courts for some years was decided by the Supreme Court on December 30, and it is therefore pertinent to call attention to it for the added confirmation it gives to the legal rights of contractors. In June, 1891, Messrs. James H. Harlow & Company made a contract with the borough of Homestead for the construction of a reservoir, agreeing "to do all the work and furnish all the materials called for by this agreement, in the manner and under the conditions hereinafter specified." The terms of the specification were plain and unambiguous; the nature and kind of work to be done, and the materials to be furnished were set forth in detail. The work was completed about a year afterward. In July, 1892, the engineer furnished an estimate showing that the amount due the contractors, but still unpaid, was $20,553. From this amount the borough held back $2,000 because the reservoir was not finished. As a matter of fact it leaked. But the contractors held that the leakage was no fault of theirs, for they had followed the plans, specifications and engineer's directions, and any failure of the reservoir to hold water was to be ascribed to them. Ever since then they have been trying to recover that $2,000, and now seem to stand a fair chance of getting it.

In the Court of Common Pleas of Allegheny County the contractors' case was considered so strong that the jury were directed to find a verdict for them, subject to a legal question which the court reserved for its own decision. From this decision the borough appealed on two claims; first, that evidence did not show the contractors were entitled to be paid, and, second, that the judge had no right to direct the jury to bring in a verdict.

Under the first claim it was held that the contractors were bound to make a tight reservoir. This contention is rejected by the Supreme Court. The specifications say that "the work contemplated is the construction of a water-tight reservoir," and the engineer who drafted them evidently thought they would produce such a result, but the contractors assumed no such responsibility. Their agreement was to carry out certain plans and specifications, and, if they had done so when the suit was brought, the money due them cannot be withheld because the results of their work are not what the engineer hoped for. The case was held to be the same as in the suit over the noted Queen Lane reservoir in Philadelphia, 37 Atl. Rep., 546, when it was held: "The contractors were given no discretion. Every line was drawn, every grade was fixed, and every detail was provided for by the city."

The borough also contended that the $2,000 was not due until the engineer filed an estimate to that effect. The Supreme Court overrules this claim, holding that the money is due when the work is finished, whether the engineer says so or not. It is for the jury to decide whether the work was completed. Unfortunately for the contractors, the judge of the trial court did not allow the jury to settle this question, but ordered them to bring in a verdict as already stated. For this reason the case has been sent back to the trial court to be tried anew.

While the principle of law involved in the case is decidedly interesting to the engineer and contractor when presented in such a form, yet it is constantly arising in one form or another. It is always settled in the same way. For example, in a recent case in New Hampshire, Perkins vs. Roberge, 39 Atl. Rep. 583, it was held that where a contractor built an oven under contract, in accordance with plans furnished to him, and it did not work in a satisfactory manner on account of the fault of the plans, he was entitled to recover the contract price.

Experiments with Peat as Fuel.

In view of the increasing price of coal and the ultimate exhaustion of Great Britain's coal resources, a correspondent of the Glasgow *Herald* asks whether they have any other material in these islands that can be utilized for fuel, which will answer all the purposes for which coal is now used, give equally good results, and be as cheaply produced. Now, so far as is known (continues the writer), the only other substance to be found in Great Britain and Ireland in large quantities—which will give the same results as coal, and in some cases superior—is peat, and in the United Kingdom there are about 6,000,000 of acres which at present are practically worthless. Ireland alone has an area of some 2,830,000 acres of the finest peat bogs in the world, which, if properly treated, would prove a source of immense wealth to that country.

The question of the utilization of these vast peat lands has long occupied the attention of engineers and the scientific world generally, but hitherto success has not crowned their efforts, for the reason that up to the present time it cannot be converted quickly into a fuel equal to coal in sufficiently large quantities, and at a cost that will pay. What, then, are the difficulties that have been encountered? The first is that the peat cannot be quickly and cheaply dried; hitherto all attempts to attain this end have failed. The second difficulty is to produce the fuel in such a condensed form, not compressed, which has proved a failure, for reasons that will be given further on, as will enable it to take the place of coal, and contain the same calorific units of heat.

Peat, as is well known, when dug from the bog contains 70 to 80 per cent. of water; therefore, to get rid of this large amount of moisture in the cheapest and most expeditious manner, without cracking the blocks, and at the same time producing a hard, heavy condensed fuel at a moderate cost is the enigma that has to be solved. At this point a short account of a few of the various efforts that have been made to turn our bog lands to account, and the many uses for which peat has been tried and found useful, may be of interest. It has been found that to produce the fuel in a hard, heavy and condensed form the peat, after it has been dug from the bog, must be thoroughly desiccated or pulped in a suitable mill, in order that the fibers or tubes which permeate it, and are filled with water, may be completely cut to pieces, as these fibers or tubes, if not completely destroyed, continue to hold the water, which turns to steam or air in the drying, and, therefore burst, thus causing the blocks of fuel to crack and fall to pieces. This is the reason why "compressing" peat has failed, because no matter how much it is pressed, immediately the pressure is withdrawn the fibers resume their natural size, again absorb some of the water remaining in the peat, and explode and crack the blocks when drying. The masticating or pulping in the mill not only facilitates the drying, but causes the peat to "condense" naturally and to become very hard and heavy.

Taken bulk-for-bulk, "condensed" peat is about four times heavier than if simply dug from the bog and air-dried. It then resembles coal,

and it is, therefore, into this "consolidated" state that it must be brought in order that it may have the same power as coal. Peat can also be converted into a very high-class charcoal, equal, if not superior, to that obtained from wood. It has long been known on the Continent as a fuel free from phosphorus and sulphur, and is there used in the smelting of iron and steel. The metal so produced is very fine, and commands high prices. The charcoal is also very useful for carbon for electric purposes, and is excellent for the manufacture of carbide calcium, which is used for generating acetylene gas. Thus peat, whether in its "condensed" or "charcoal" form, has been found by practical test and theoretical calculations to answer all purposes where great heat and purity of fuel are required.

When peat was first used as a fuel we have no means of telling. In 1849 a Mr. Rees Rice took out a patent for the utilization of peat, and works were erected at Athy, in Kildare, Ireland, for the purpose of distilling and obtaining the useful by-products from it. The idea was derived from the application of inflammable gases for heating purposes, which were to utilize inferior coal and other combustibles by converting them into gases, and obtaining the various products contained in them.

From peat there may be obtained by distillation pyroligneous acid, a brown empyreumatic, crystallizable oil from which paraffin, ammonia and other chemicals may be extracted. Many experiments have been made with peat. The late Duke of Sutherland spent considerable sums in endeavoring to utilize the peat bogs on his estates. Sir John Ashley, we believe, started works on Dartmoor, and more recently Lord Malcolm of Poltalloch has also experimented; but the cost of production was too great, nor could the fuel be dried quickly. The largest experiment that has been made in recent years was at Horwich, near Bolton, in Lancashire, where there is a bog of very fine peat of great depth called the Red Moss. The works were established in 1863 to work a patent of the late William H. Buckland. They were erected at a cost of $600,000, and not only contained the machinery to produce condensed peat and ovens to convert it into charcoal, but a small blast furnace was also built capable of turning out 80 tons of charcoal pig iron per week. These works were carried on for some years; the iron produced was of a very high class, and was made entirely from British ores. Those who used the metal pronounced it to be far superior to any smelted with coal or coke. It was also proved at the Horwich works that iron of a high class could be made by using the condensed peat blocks as a fuel once the supply of charcoal failed, and to keep the furnace going condensed peat was used, with the result that a fine iron was produced. This company had the same trouble as all the others, viz., they could not dry quickly and cheaply, although the fuel they produced was of excellent quality.

In the conversion of 1 ton of condensed peat into charcoal 13,000 to 14,000 cubic feet of gas free from sulphur is produced, of a high heating and illuminating power. The late Dr. Versman, consulting chemist to the Commercial Gas Company, of London, to whom a sample of the condensed peat produced at Horwich was submitted, stated "That a ton of the peat, the specific gravity of which was 810, and containing 93 per cent. of moisture, yielded 13,160 cubic feet of gas, equal to 16½ sperm candles." He adds—"The only true obstacles which I could find against the permanent application of peat for gas purposes are completely removed by this condensed fuel, which in a simple and most efficient manner produces a peat containing considerably less moisture than coal; and the charcoal obtained from it is of the most dense and compact nature, resembling wood charcoal in its properties. I, therefore, consider the process of the utmost importance, and that at no distant time it will considerably influence the art of gas making. By the introduction of condensed peat into gas works a very considerable saving must be effected." Condensed peat has also another advantage over coal, as it is practically smokeless and contains less ashes. The following table will show the average quantity of ash from coals from different localities:

Wales	4.91
Newcastle	3.77
Lancashire	4.88
Scotland	4.63
Derbyshire	2.65

The ash contained in 27 varieties of peat gave a mean average of 2.62, which is less than the coal obtained from any of these districts. The absence of smoke is also a great point in its favor; but even when mixed with coal in certain proportions it entirely does away with the dense, black clouds which are so obnoxious in our cities, and for the creating of which nuisance our owners of steam power so often get fined. At a recent trial on a steamer where the fuel was used mixed with coal, there was an entire absence of black smoke, the speed was 17 to 18 knots, and steam was kept up well. The fuel has also been thoroughly tested on locomotives, and found to answer all the purposes required. On an express train where the peat was mixed with coal there was no black smoke. Although the coal used was of an inferior quality, there was plenty of steam and the consumption was 31.4 pounds to the mile.

If we compare pig iron that has been made from the same ore, the one smelted with coke and the other with peat charcoal, a marked difference will be observed. Cleveland ore was taken and smelted into No. 3 Clarence with coke, while another parcel was smelted with peat charcoal:

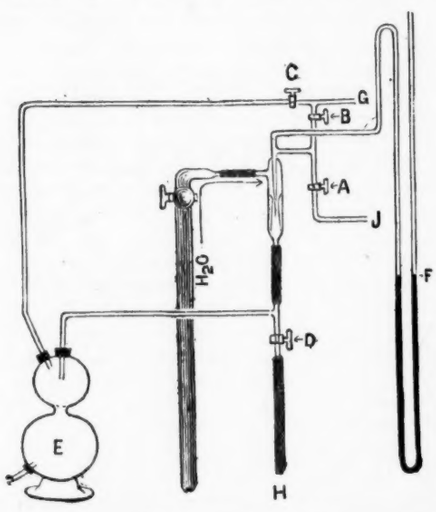
Coke.	
Carbon	3.41
Silicon	2.73
Manganese	0.37
Sulphur	0.17
Phosphorus	1.23
Titanium	0 14
Iron	93.66
Peat Charcoal.	
Carbon	0.043
Silicon	0.199
Sulphur	Trace
Phosphorus	0.031
Manganese	0.158
Titanium	—
Iron	98 571

Thus it will be seen that peat, when properly prepared, is quite equal to coal for all purposes. To make it a commercial success, the peat, after it is dug from the bog and placed in the pulping mills, should not be handled again until it comes from the drying machine in a perfectly hard and condensed state, which operation must not take more than 10 hours. The fuel should then be ready for either burning or converting into charcoal.

A Combined Exhauster and Blower.

Mr. Edwin Dowzard, in *Chemical News*, describing an apparatus devised by him for simplifying operations in the rough in the chemical laboratories of manufacturing concerns, remarks that in such concerns the supply of apparatus is not prodigal, wherefore a chemist has frequently to utilize old and damaged pieces of apparatus. Continuing, Mr. Dowzard says:

In the accompanying illustration it is shown how, with the aid of a



damaged Kipp's H_2S apparatus, an ordinary filter pump may be converted into a combined exhauster and blower.

We will suppose that the water is turned on, and the taps *A*, *B*, *C* and *D* are open. If *D* and *B* are closed, the mixture of water and air from the pump will pass into the Kipp's apparatus, instead of passing through *H*; in a few seconds the outlet *I* will be covered, and a current of air will be delivered at *G*; of course the taps *A* and *C* must be left open. It is necessary to regulate the size of the outlet *I*, so that the water in *E* never reaches higher than the dotted line.

If we now open *D* and *B*, and close *C*, there will be suction at *G* and *J*; the vacuum so produced (if used to exhaust distillatory apparatus, etc.), is measured by the gauge *F*.

Of course, the taps *A*, *B*, *C* and *D* may be replaced by burette clips, etc.

Pneumatic Engineering.[1]

The revival of interest in pneumatically operated machinery has been a marked feature of the last few years. Side by side with the development of electricity as a handy means of transmitting energy, we have seen arise a very considerable and increasing use of compressed air for the same purpose. Pneumatic engineering underwent a considerable development in the first half of the nineteenth century, and the practice now often advocated of driving heavy machine tools by independent motors in place of by line shafting, was anticipated in the workshops of Messrs. Boulton & Watt by a fairly complete installation of small vacuum motors. It is interesting to note that most of the earlier workers in pneumatic engineering appeared to have a preference for vacuum rather than pressure plant, though the latter would permit of the adoption of much lighter and more compact designs. This may have been due to the lack of experience in the making of good joints; but, be this as it may, the preference noted cannot be disputed. Even the atmospheric railway, on which enterprising but badly advised directors and shareholders wasted so much money, was operated by suction, though this required the use of a very large tube for the piston to travel in. On the other hand, of course the low pressure tended to reduce the leakage losses, which, even as matters stood, proved excessive, the power actually needed being about 2½ times as much as the engineer's estimate. Incidentally, the fact that these lines could be operated at all, is a testimony to the excellent work turned out by the early founders. It seems that the pipes were not bored, and it would, therefore, have been natural to expect very rapid wear of the piston packings and very considerable leakage past them.

From the testimony of passengers, it is clear that the system had certain advantages, the motion being exceedingly smooth, and unaccompanied by noise, cinders or dirt. The sole reason of its failure lay in the difficulty of securing a tight joint over the slot which admitted of connection between the moving piston and the train, and, deprived of this feature, the system has, as everyone knows, proved remarkably successful in the case of the small dispatch tubes adopted in London, Paris and Berlin for transmitting telegraph messages between central and sub stations. An attempt to conduct operations on a large scale failed. The tunnel constructed for this purpose between Euston and the General Post Office, which measured 4 feet by 4 feet 6 inches, built in the early sixties, failed, it is true, to meet expectations, the leakage proving much greater than anticipated; but with some important modifications, this plan of transmitting mails has recently been most successfully adopted in the United States. The first tube for conveying mail matter was laid down in Philadelphia in 1893. The tubes used are 6 inches in diameter and the carriers are 18 inches long, holding about 300 letters. It had been intended to use wrought iron tubes, but these proved totally unsuitable, and resource had to be had to cast iron sp'got and socket pipes, which were bored to size by special tools devised by Mr. B. C. Batcheller.

These improvised boring mills proved highly efficient, and by their aid 6,000 feet of tubing were bored in the short space of six weeks. The boring was effected by a cutter-head fitted with six tools, and drawn—not pushed—through the pipe to be cut. When the feed is thus applied, the cutter-head tends to follow a straight line, and behind it was guided by blocks of hard wood fitting the finished size of the bore. The deviation from the nominal finished size did not exceed $\frac{1}{16}$ inch, which was immaterial for the purpose in view. A second cutter-head finished the socket central with the axis of the bore. All bends were made of brass pipe bent to a radius of 5 feet. The great weight of the carrier and the high velocity at which it was moved, necessitated provision for stopping it without shocks at the receiving end. This was accomplished by an ingenious application of an air cushion. The plan proved so successful that the Post Office authorities determined to employ a similar system at New York, and here an 8-inch tube was adopted, the carrier for which is 24 inches long by 7 inches in diameter. It is surrounded by two bearing rings of woven cotton fabric which take the wear, and can easily be renewed. This, however, is only necessary, after 4,000 to 5,000 miles have been run, by which time the wear has reduced them to ¼ inch less in diameter than the tube.

Three circuits of tubes have been laid down in New York, the most interesting of which is perhaps that from the General Post Office to Postal Station H, at Lexington avenue, a distance of 3½ miles away, there being four intermediate stations *en route*. Great ingenuity has been expended in designing the receiving and transmitting apparatus both at the terminal and at the intermediate stations.

The carriers are automatically stopped at any intermediate station by fixing in front of them a steel disc of a certain size. When the carrier thus fitted approaches the station desired, this disc comes in contact with two electrodes extending into the tube and completes a circuit, the current through which then brings the receiving gear into operation. This receiving gear consists in the first place of a closed chamber forming a prolongation of the main tube, and acting as an air cushion. Into this chamber the carrier is shot and brought to rest, the air passing on to the line tube through a by-pass. This chamber is mounted on a wheel, and should the carrier be destined for another station this wheel revolves through an angle of 90°, bringing the carrier in line with a tube leading to the next station. The carrier is then blown out into this tube and proceeds on its journey. If, on the other hand, it is fitted with the proper contact disc, the current is completed through an electromagnet, which throws a stop into the motion of the wheel, which is accordingly arrested, and the carrier discharged on to a table. The open ends of the tubes are closed by the broad rim of the wheel as the latter rotates. The speed at which the carriers run is about 35 miles an hour, the pressure used being, when many carriers are in progress, as much as 17 pounds per square inch at the compressor end of the tube. In spite of the rigidness of the joints, breaks from settlement appear to have caused but little trouble. When they occur the position of the fracture is located by measuring the time taken for the report of a pistol to reach the point where the carrier is obstructed by the break and to return, this plan being identical in principle with that originally adopted for the small dispatch tubes in use in this country.

Coming to the other fields, the revival of interest in pneumatics has been equally remarkable. As an agent for driving portable tools in the workshops, electricity had the start of compressed air, but now seems likely to be completely set aside for a very large variety of tools. The pneumatic hammer, now so highly appreciated by all progressive manufacturers, was introduced in the first instance for stone cutting, and only slowly made its way into metal working shops. The earlier types suffered, or perhaps we should say caused their users to suffer, from excessive vibration, but this has been greatly reduced in the more modern types. A later application of the hammer, and one which promises to take a great development, is to riveting. No doubt there s a justifiable prejudice in favor of pressure riveting, particularly when the machine used is fitted with a plate closer; but in face of the millions of rivets which have been closed by hand in our shipyards for years past, it is impossible to maintain that good work cannot be accomplished by percussion. The percussion riveters have an immense advantage in their lightness. A portable percussion riveter, suitable for closing ¾-inch rivets and having a gap 40 inches deep, weighs about 120 pounds. A portable hydraulic riveter of equal capacity would weigh about 10 times as much. Further, the low pressure at which the pneumatic tool is supplied is a great advantage, as it simplifies considerably the task of connecting the riveter with the supply main. Again, there being no absolute necessity in the case of percussion riveting for the holder up and hammer to be connected to the same frame, it is possible to drive rivets with the percussion tool that would be absolutely inaccessible to a pressure riveter. Another valuable workshop appliance is the pneumatic hoist, which is, it would seem, a direct outcome of the Westinghouse brake, having originated, we believe, in a railway shop, where the ready availability of Westinghouse compressors was a powerful incentive to the adoption of compressed air for lifting purposes. These hoists are remarkably handy, and the fact that, unlike blocks and tackle, their use calls for no physical exertion leads to a considerable saving of time in the shops, as a machine minder is not tempted to wait for the assistance of a laborer before setting or removing a heavy piece of work.

Electricity will doubtless be largely employed in the workshop of the future, but it will be in conjunction with and not to the exclusion of compressed air. For long distance transmission work compressed air is likely to be entirely superseded by its rival, the success of the Popp plant notwithstanding. No reasonable increase in working pressure will enable the compressed air to compete in this field with the electric current where any large power is to be transmitted. With high pressures moreover it would be difficult both to prevent and to correct serious losses from leakage on the transmission line, to which must also be added the necessarily low efficiency of the plant at the compressing station, and of the motors at the point of distribution.

1. From *Engineering*.

A Life Test of Incandescent Lamps.

[A paper read by Mr. George D. Shepardson at the last meeting of the Northwestern Electrical Association.]

About three thousand years ago a famous engineer and electrician built on a high hill a temple so thoroughly protected that in the thousand years of its existence it is said not to have been struck a single time by lighting. This wise man one day wrote: "Of making many books there is no end, and much study is a weariness to the flesh." Had he been a modern electrical engineer, he might have added: "Of making incandescent lamp tests there is no end, and much report of them is a weariness to the flesh." Yet new books are useful in presenting old or new truth in a fresh light; so tests of incandescent lamps may be useful in calling attention to points that may not be familiar to all and that are not realized by all. In this paper it is not intended to present a general discussion of the whole lamp situation, nor to give a resumé of what others have done, but simply to report results of certain tests a little out of the usual order.

The general subject of the importance of testing incandescent lamps, together with a report and discussion of the results of an extensive and careful test of lamps made by a large consumer, may be studied in an excellent article in *Electrical World and Engineer*, March 18, 1899, and in a valuable pamphlet published by the General Electric Company. For the test mentioned above, lamps of 12 different factories were purchased n the open market and were given a preliminary test for uniformity of candle power and wattage. Four makes of lamp were rejected at once on account of lack of uniformity. Ten lamps of each of the remaining makes were selected for a life test, those being selected which came the nearest to the standard rating and efficiency. This test may therefore be taken to show the best results of the best lamps of the best makers.

In order to discover what is likely to be the experience of the buyer who lacks either the ability or the inclination to test all lamps received, and to reject those which do not meet his specifications as to candle power and wattage, the following experiments were carried on in April and May, 1899. To secure average conditions prevailing in the Northwest, lamps rated at 16 candle power were picked at random from the stocks of the Minneapolis General Electric Company, the St. Paul Gas Company, the Faribault Gas and Electric Company, the Owatonna Electric Company, the Electrical Engineering Company, of Minneapolis, and from the agents of two lamp factories which were already represented by lamps secured from other sources. Current was kindly furnished by the Minneapolis General Electric Company. The experiment was conducted by Henry A. Hildebrandt and Arthur C. Pratt, senior students in the University of Minnesota. The lamps were run on an alternating current line whose voltage was maintained constant within a range of two volts, a recording voltmeter giving a continuous record of the fluctuations. The candle power, wattage and efficiency of the lamps were determined with direct current and a Lummer-Brodhun photometer with Weston voltmeter and Whitney milliamperemeter, which were calibrated before and after the test. The standard of light was a well aged incandescent lamp which had been standardized by a certified amyl acetate lamp and by standard candles, being frequently c.ecked by a second and similar standardized incandescent lamp.

Ten lots of lamps from 7 lamp factories were first tested for candle power and wattage at their marked voltage. As shown by the tables (on page 331) the initial candle power of the 55 lamps varied from 14.1 to 23.0, while the watts per lamp varied from 47.3 to 71.3, the watts per candle varying from 2.32 to 4.10. The average candle power of the lamps of each group varied from 15.2 to 22.0, while the average watts per lamp varied from 49.0 to 66.4, and the average watts per candle varied from 2.42 to 3.60. The general average for the 55 lamps given a preliminary test gave 18.3 candle power at 55.8 watts, or 3.1 watts per candle. This indicates that the central stations in this Association are using lamps of higher efficiency than was common a few years ago, also that there is still a wide range in the candle power, wattage and watts per candle of the lamps in use. It might be noted that the watts per candle were specified on only one lot of lamps, another being called "of standard efficiency," while a third lot was called "high efficiency," the latter taking about 3 watts per candle.

The different lots of lamps were marked A, B, C, D, E, F, G, H and I, and four lamps were selected at random from each lot except I and H. The ratio between the mean horizontal candle power and that in a certain marked position was carefully determined. Lamp sockets were wired to heavy leads, and resistances were adjusted so that each lamp received the voltage marked on the label. The sockets were placed so that the lamps were horizontal and each lamp was always placed in the same socket in order to make the conditions of dropping alike for all. At intervals of about 24 hours, each lamp was removed to the photometer and tested for candle power and current. Each lamp was allowed to burn until the end of the test or until it broke or met an accident. It was not thought advisable to throw out each lamp when it dropped to 80 per cent. of its initial candle power, since it is believed to be the exception rather than the rule for the smaller stations (not excepting most of the larger) to pay much attention to the "smashing point" or economical life of an incandescent lamp unless a customer complains about poor light. (It might be considered unprofessional to inquire how many of the stations represented in this convention have any regular system of removing old and inefficient lamps).

After burning about 50 hours, it is found that the light varies from 8.2 to 23.0 candle power, while the watts per lamp vary from 45.7 to 72.1, the watts per candle varying from 2.32 to 4.10, the general averages being 17 5 candle power at 55 watts per lamp and 3 27 watts per candle.

After about 100 hours, the light varies from 10.1 to 22.3 candle power, the watts from 45.5 to 72.1 per lamp and from 2.52 to 5.02 per candle. The general averages are 17.5 candle power at 55.3 watts per lamp and 3.30 watts per candle.

After about 400 hours, the light varies from 11.3 to 19.0 candle power at 46.6 to 70.2 watts per lamp and 3.00 to 4.31 watts per candle. The averages give 16.0 candle power at 56.5 watts per lamp and 3.54 watts per candle.

After about 600 hours, the lights vary from 11.4 to 18 8 candle power at 44.0 to 69.9 watts per lamp and 3.34 to 4.26 watts per candle. The averages give 14.7 candle power at 55.6 watts per lamp and 3.82 watts per candle.

A few lamps were burned 800 to 900 hours, after which time the candle power varied from 10.8 to 16.4, while the watts per candle varied from 3.60 to 4.40.

Early in the test it was noted that several of the lamps "burned blue" and their high efficiency pointed to an early demise. All four of the lamps of lot A had burned out in about 100 hours and none of those in lot B lasted more than 500 hours, only one of them lasting 350 hours. These two lots were from lamps bought by a large company who contemplated changing lamps, and it is not certain whether these lamps were high economy lamps sent for trial or whether they were lamps intended for lower voltages but marked to suit the voltage ordered. Their performance suggests that the lamp makers find it necessary to dispose of their product and must mark their lamps to suit orders if the orders persistently call for lamps of the same standard voltage. It emphasizes the request made by some of the lamp makers that stations would find it to their advantage to adopt some odd voltage in order to use the lamps which must be made to supply other standards.

To get some comparison between the behavior of lamps on constant potential circuit and those on a circuit with poor regulation, several lamps were placed on a circuit varying from 104 to 118 volts. The lamps so placed were not sufficiently numerous to give close conclusions. The high efficiency lamps all died within about 300 hours, while most of their mates of like make on the well regulated circuit were in fair condition at 800 hours. The candle power and efficiency of the lamps on fluctuating circuit fell in 300 hours as much as did that of the lamps on the constant potential circuit in 800 hours. The lamps on the circuit with voltage fluctuating 13 volts aged at least three times as rapidly as their equals on a circuit fluctuating two volts. Such a statement can only give a rough idea of the general effect since the result of a fluctuation depends upon whether it varies above or below the normal. The lamps of low initial efficiency (that is those which took 3.5 to 4.0 watts per candle) withstood the extreme variation much better than did those of higher efficiency, as was to be expected.

After the above test had been ended, some of the lamps were placed on the photometer and the voltage was raised until the candle power equalled the initial value. Three lamps marked for 108 volts were raised to 111.4 volts and to 112.6 volts to restore them to their initial candle power. Another lamp marked for 110 volts, which had burned 558 hours on the circuit with widely fluctuating voltage, was raised to 120 volts before its candle-power equalled that of its youth. The efficiencies of these lamps at the higher voltage were from 1 to 8 per cent. lower than their original efficiencies. This seems to justify the practice of some engineers who move old lamps to places on the circuit having higher average voltage. To what extent the economical life of a lamp may be extended by raising the voltage from time to time, is a matter that seems worth investigation. In this connection it should be stated that very few of the lamps showed any considerable blackening, so that the loss of light and efficiency with age seem to come more from

change in the filament than from absorption by the coating inside the bulb.

As a matter of interest, several lamps were gathered from various sources and their candle power measured while dirty with the accumulations of time and after the same were washed off. The light was increased from one to thirty per cent. The following are the tables:

Initial Measurements—Lamps New.

Lamp.	Number Tested.	Candle Power.			Watts.			Watts per Candle.		
		From.	To.	Average.	From.	To.	Average.	From.	To.	Average.
A	5	18 9	21 0	20 0	50.3	51.3	50 7	2.45	2.65	2 57
B	4	21 3	22.7	22 0	51 1	55.8	53 0	2 32	2 55	2 42
C	7	15 2	18 7	17 0	47 3	49.7	49 0	2.66	3.22	2 92
D	6	17 3	23 0	20 8	61 3	71 3	66.4	2 87	3.68	3 23
E	6	17.3	19 1	18 0	58 3	60 6	59 1	3.13	3.45	3 29
F	9	15.8	16 8	16 4	50 9	58 2	53 0	3.12	3.58	3 24
G	6	18 2	20 9	19.2	55 7	57 8	56 6	2 67	3.10	2 95
H	6	14 1	19 9	16 8	53 3	62.7	58.4	3.14	4.10	3 50
Ia	3	14 8	17.4	15 2	53 6	54 4	54.0	3.12	4.07	3.60
Ib	3	16.6	20 4	19 0	55.9	61.9	58.0	2.78	3.35	3 07
Total.....	55	14.1	23 0	18 3	47 3	71.3	55.8	2.32	4.10	3 10

AFTER BURNING 50 HOURS.

A	4	17 0	18 6	17.9	49 6	50.0	49 8	2 67	2.90	2.78
B	4	20.0	22 6	21.4	50 8	55.0	53.1	2 44	2.53	2.48
C	4	15 1	18.2	15.8	45 7	50 2	48 5	2 76	3.75	3 13
D	4	17.9	23.0	21.2	66 6	72.1	68 8	3.00	3.86	3.28
E	4	15.5	20 0	17.3	57 2	60.9	58 9	3.02	3.71	3.43
F	7	8 2	17 0	12.4	47.5	58.3	51 4	3.14	5.80	4 31
G	4	18 6	21 0	19.7	56 2	57.9	57.0	2.70	3.07	2.91
Total.....	31	8.2	23 0	17.5	45 7	72 1	55.0	2 44	5.80	3.27

AFTER BURNING 100 HOURS.

A	1	16.4	16.4	16.4	48 6	48.6	48 6	2.98	2.98	2.98
B	4	19 7	21.4	20 5	50 8	54.6	53.1	2.52	2 64	2.59
C	4	11.7	18 2	15.7	45 5	50.0	45.7	2.75	3.90	3.13
D	4	17.2	22 3	20.7	66 4	72.1	68.7	3.07	4.04	3.36
E	4	15 8	20.7	17.7	57.8	61 1	59 3	2 93	3.66	3.39
F	6	10.1	17.7	13 1	49 4	58 3	51.8	3 00	5 02	4.09
G	4	18 4	20 8	19.7	56 1	67.8	57.2	2 78	3.06	2.92
Total.....	27	10.1	22 3	17 5	45 5	72 1	55 3	2.52	5 02	3.30

AFTER BURNING 400 HOURS

B	1	17 0	17.0	17.0	51.3	51.3	51 3	3.00	3.00	3.00
C	3	14.2	15.4	14 8	46 6	49 2	48.1	3.16	3.28	3.25
D	4	16 4	19 0	18 4	65.3	70.2	67 5	3.19	4.18	3.67
E	4	16 0	18.0	17.0	57 4	60.8	59 0	3 36	3.58	3.48
F	5	11 3	16 5	13.2	48 5	58.3	51 4	3 16	4.31	3 95
G	4	15 8	17 8	17.0	55 0	57.2	56 6	3.21	3.62	3.34
Total.....	21	11.3	19 0	16.0	46 6	70 2	56 5	3.00	4.31	3.54

AFTER BURNING 600 HOURS.

C	3	13.0	14.0	13 6	45.9	49.0	47.3	3.34	3 60	3.46
D	4	16 2	18.8	17.5	65.5	69.9	67.2	3 49	4.26	3 87
F	4	11.4	14.0	12 6	44.0	58.3	50.1	3 41	4.28	3.99
Total.....	11	11.4	18.8	14 7	44.0	69.9	55.6	3.34	4.26	3.82

Individual Lamp Performance.

Lamp	Life	Candle Power.			Watts Per Candle.		
		Initial.	Final.	After 500 Hours.	Initial.	Final.	After 500 Hours.
A1	94	19.1	16.8	....	2.56	2.93	....
A2	93	21.0	18.6	....	2.45	2.65	....
A3	79	20.6	16.9	....	2 47	2 95	....
A4	107	18 9	16 4	....	2 66	2 98	....
B1	488	21.8	17.3	17.3†	2 55	3.12	3.12†
B2	330	22.2	16 9	....	2.38	3.05	....
B3	305	20.6	14.8	....	2.47	2.96	....
B4	347	22.6	13.2	....	2.32	3.30	....
C1	603	18 7	13.0	14.0	2 68	3.60	3.45
C3	883*	18 0	13 4	16.6	2.75	3.62	3.20
C4	883*	15.2	12.6	14.0	3.02	3.60	3.35
D1	883*	21 2	15 5	17.9	3.12	3 90	3.63
D2	883*	21.3	16.4	17.5	3.37	4 22	4.00
D3	883*	21.0	15.9	16.3	3.32	4.30	4.26
D4	883*	23 0	15 8	19 5	2.90	4.08	3.37
E1	487*	17 3	17 3	17.3†	3 46	3.42	3 42†
E2	487*	19.1	17 4	17.4†	3 08	3.48	3.48†
E3	486*	18 6	16.2	16.2†	3.14	3.51	3.52†
E5	486*	17.5	16.1	16.1†	3.33	3.56	3.56†
F1	462	16.7	12.2	....	3 12	4 00	....
F2	793*	16.6	13.0	11.7	3.14	3.73	4 16
F3	793*	16.2	13.1	14.1	3 58	4 23	4 10
F4	793*	16.5	10.8	11.5	3.23	4 40	4.28
F6	595	20.0	12 9	14.2	2 76	3 42	3.65
F8	40	17.4	8.2	....	2.98	5.80	....
G3	435*	18.2	15.7	15.0†	3.10	3.65	3.70†
G4	435*	19 1	16.1	15.0†	2 93	3.38	3.60†
G5	435*	20.9	17.1	16.2†	2.67	3.35	3.50†
G6	435*	19.2	17.4	16.5†	3.02	3.27	3.40†

NOTE.—Lamps marked * were in fair condition at close of test. †Figures estimated from curves.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Feb. 10, 1900.

The Lot of the Gas Worker.—Coal and Coke.—The London Gas Companies.

A paragraph under the peculiar title of the "Gas Workers' Paradise" has lately been running the rounds of the technical press. It does not refer, as might be supposed, to an ultramundane state of things, or to a future compensation especially intended for all deserving members of that craft, but is descriptive of the happy condition of affairs prevailing at the Leicester Gas Works, in the way of provision for the well-being, recreation, and intellectual advancement of the workmen. The author is evidently an Englishman, as he commences by describing the comforts of the mess rooms—the most important feature, it is to be feared, in many person's idea of "Paradise"—and passes on to notice the bath rooms, then the lecture hall, reading rooms, brass band, ambulance society, and so on. But he is wrong in supposing that Leicester is unique in this respect, or that arrangements for the comfort and well-being of gas employés are in any sense a novelty. More than one large works has developed technical classes, reading rooms, etc.; the majority are well provided in the way of mess rooms; many have recreation grounds, and a particular one comes to mind which includes a bicycle or racing track with grand stand, and a lawn tennis ground. All this is no detraction from the efforts that appear to have been so successful at Leicester. But the results there recorded are equally creditable to the men themselves. The masters are to be commended for the trouble and expense, without which the various advantages could not have been forthcoming. But the men are equally deserving of praise for accepting these institutions in the right spirit, and for devoting their spare time and energy to an appreciation of the same.

The term "Gas Worker" may be used in a wide sense as indicating anybody engaged by a gas company. But its usual acceptation is confined to the retort house hands who actually make the gas. Many of the clerks, gasfitters, laborers, etc., are in no sense differently situated from the ordinary run. They have their regular hours of labor and their evenings, Sabbaths, and general holidays off, with plenty of change of air and scene. But the gas worker's toil is arduous, and carried on in the dreary, monotonous surroundings of the retort house. Anything that can be done to infuse freshness and variety into his colorless life is deserving of cordial encouragement, and usually receives it. Yet the difficulty very often rests with the men themselves. They cannot be compelled to use the bath or reading room, or to join the brass band, unless they desire to do so, and are prepared on their side to loyally support the efforts that are put forth. The majority of gas workers are, like many other people, a slave to the fetish of "high wages." They believe that another shilling or two a week *must* be an advantage, and entirely forget that every increase of income, however slight, brings increased responsibility, and that the real advantage is to be found, not so much in having more to spend, as in the way it is spent. Some are inclined to question the spirit that prompts the provision of these benefits. They do not believe in doing good for good's sake, and suggest the existence of some ulterior motive in the direction of more work and less wages, or of limiting independence of action. They do not hesitate to say plainly that if there are funds available for building lecture halls, etc., they would rather spend the same themselves than have it spent for them, and that it ought to be divided out in the form of higher wages on Saturday night. Others again have settled into their own particular rut, and regard any attempt to move them out of it as an unwarrantable interference with personal liberty. Dickens in one of his works describes a fat boy who believed in getting as much beer, meat and sleep as possible, and this character represents a large class. In one instance, when the works was extended, an excellent bath room was provided for the use of the retort house men. After a month or two it was observed that it was never used. On inquiry it was found that the idea of a bath room being a necessity or a benefit was not accepted, but that it was regarded as a sort of sarcastic reflection on their habits. They protested that they had always been accustomed to wash before leaving the works, that they always put on clean flannels once a week, and so on, and that the bath room was an unnecessary innovation. In a general way it may be said that the working classes regard any efforts of a philanthropical character from a different point of view to that of the promoters. Where they show a real desire for improvement in any way, the means are usually forthcoming. And I think that no instance could be quoted of any body of gasworkers who wished for means of improvement or recreation, and did not find themselves met more than half way by their employers. The Leicester paragraph may well be largely circulated, not so much amongst managers and shareholders, as in the ranks of the gas workers themselves, in the hope that they may be led to see that their lives need not of necessity be flat or colorless, or without any other solace than the treacherous satisfaction afforded by the pipe and the pewter pot.

The coal trade is still in an unnaturally, inflated state. A few weeks of cold, frosty weather have strengthened the hands of those who pull the ropes and enabled the position of affairs noted last month to be maintained. The general public appear to submit contentedly to any price that may be asked. Fortunately most gas companies are fully

covered by contract, but those who are obliged to buy at current prices are probably paying more for the coal than they will receive for the gas made from it. In many instances the consumption has exceeded anticipation, and more coal has therefore been consumed than was expected. Under such circumstances the manager would be thankful to see mild weather and a decreased consumption instead of an increase. The severe cold weather, in fact, affects gas undertakings as it does in dividends. The strong and robust, otherwise the well provided, plenty of retorts, coal sheds full, etc., do well and thrive. But the weakly and those who lack food and firing, which represent the cramped works and small stocks, are hard pressed by it. The one bright spot is the coke yard, or rather the place where coke is usually kept, for it is empty now. And the hard pressed manager who has to sell gas at bare living rates, after anathematizing the rapacious coal merchants can solace himself by a revision of the residuals price board. Many, however, are limited in this respect by the fact that there is a considerable amount of cheap coke about the country. Several of the larger works sell considerable quantities by contract to parties who will take it out of their district. This means that the coke goes somewhere else, and is brought to bear as a competitor with the local gas works. The result of this policy is that in many localities situated midway between three or more large works the price of coke is always less than its intrinsic value as compared with other fuels. Frequently it happens that in two towns, A and B, say 50 miles apart, large quantities of coke from A are sold in B, at rates below the current prices in A, while the surplus sold at a take-it-away price in B, finds its way in a similar manner to A. This state of things is profitable to the railway companies but to nobody else, and cannot but have a depressing influence on the market generally. We have a Sulphate Makers' Association for dealing with matters relating to the market prices of sulphate of ammonia. And there is room for a coke makers' association to prevent such anomalies as a company saving, say, £100 to themselves and causing others to lose £200 in the process. It is a source of weakness to any trade, when the "middle-man" is able to control prices. The other residuals, tar and sulphate, are improving in value, so that those who are in a firm position, both as to buying and selling, will be able to recover the increased cost of coal in the form of larger returns for residuals.

The reports of the principal London Gas Companies for the half-year, ended 31st Dec., 1899, have been issued, and as usual they reflect to a certain extent the state of affairs throughout the country. An abnormal increase in consumption of gas, no abatement in the demand for stoves and for automatic meters, a shortage of coal supply, a larger coal bill and a good advance all along the line in the matter of residuals, are not the experience of the metropolis alone, but that of the country generally. The Gas Light and Coke Company supplied, either on sale or hire, no less than 13,000 gas stoves during the six months, of which something less than half were fitted in connection with automatic meters; 7,336 new customers were laid on under this system, more than three-fourths of whom were also provided with stoves, and 2,314 new ordinary customers. The Company supply gas to 351,314 meters, and have 208,000 stoves, exclusive of those not supplied through the Company, so it is not far wrong to say that two-thirds of the users of gas are also users of gas stoves. The South Metropolitan Gas Company report an increase of 8¼ per cent. in the quantity of gas sold. They have added 8,000 to the list of automatic meter customers exclusive of 2,300 new ordinary customers, and they have now 95,000 customers under the slot meter system. A very satisfactory feature in each case is that the output of stoves exceeded the additions to the consumers roll, showing that an appreciation of the advantages of gas for cooking and heating is steadily growing. Allowance must be made for the fact that some customers hire more than one stove. But having done that we may claim that the use of gas stoves is becoming universal. Not so very long ago a ratio of 1 to 3 or 1 to 4 was considered excellent work. The instance of a small town having 600 stoves amongst 2,000 customers, was especially quoted. But evidently the time is approaching when a gas consumer who does not also use a gas stove will be an exception. The South Metropolitan Gas Company give a comparison with the year 1889, which is interesting as showing the progress of the industry during the past 10 years. The sales of gas have increased 72 per cent., but the capital only 40, and the interest 20 per cent. The price of gas has been reduced from 2s. 3d. to 2s. 1d. per 1,000 cubic feet in spite of increased manufacturing costs. In 1889 the net cost was 1s. 3.1., and the profit 1s. 0d. In 1899 the net cost was 1s. 4½d. and the profit 8½d. per 1,000 cubic feet. These figures show that the consumers, no less than the shareholders, benefit by an enterprising policy in pushing and increasing sales. For while the working costs have risen 1½d., on account of dearer coal and higher rates of wages, the consumer is actually paying 2d. less, or 3½d. less than he would have to pay if the consumption was still standing as it was in 1889. The directors intimate plainly, however, that the present state of things cannot be maintained if the coal market continues as at present, or if the London County Council are successful in their endeavors to get the portable photometer recognized as a legal instrument. The effect of the last named would be that the actual illuminating value of the gas must be increased to the extent of 2 to 3 candles, which would mean a considerable addition to the cost of manufacture. At present the gas supply is tested in rooms situated in principal streets supplied from the main arteries of the system. But the County Council wish to be able to take a portable photometer into any room, or erect the same at any place where they can get at the gas, and there take a legal test. It is obvious that by careful selection of the testing place, so as to secure a stale sample that has been laying in a "dead" pipe for days or weeks, a penalty could be scored against the company at any time, although the bulk might be 20 or 25 per cent. above standard.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE following circular to the members of the American Gas Light Association, issued some days ago, explains itself:

You have probably received from the Commission of Organization of the International Congress of the Gas Industry a circular calling your attention to the nature of the Congress, and the means to be employed to secure the benefits of participation in its proceedings, either by being present at the Congress, or by the receipt of the report of the proceedings when published. This circular, after repeating the gist of the letter, a translation of which was appended to the Report of the Council presented to the Association at its last meeting, and is printed on pages 13 and 14, Vol. XVI. of the "Proceedings," states that the Congress will be held Paris, the 3d, 4th and 5th of September, 1900, in the Hall of the Congresses, at the Exposition. The programme has not yet been definitely arranged, but the circular contains some of the questions which have been suggested, and states that the Commission will be pleased to receive further suggestions. At a later date the programme will be definitely arranged, and will be sent to those fulfilling the necessary conditions.

The papers to be read are to be sent in before the 1st of June, so that they can be printed in advance in time to be sent to those members of the Congress who shall request that this be done. While papers may be written in either English, French, German or Italian, the Commission prefer that they should be in French.

The price of membership in the Congress will be 20 francs (about $4), and will entitle the subscriber to participate in all the meetings, all the discussions, and all the visits which shall be arranged, and also to the receipt of the published proceedings of the Congress immediately after their publication. Members of foreign Gas Associations, who pay an annual assessment to their respective Associations, are exempt from payment of the charge of 20 francs, but they will not receive the publication free of charge unless they are present at the Congress, so that those members of the Association who wish to secure a copy of the proceedings as published, and do not intend to be present at the Congress, must pay the sum of 20 francs as above. Remittances for this purpose should be made to "Le Tresorier de la Commission d'Organization du Congres International de l'Industrie du Gaz, en 1900; Rue de Provence, 65, Paris." It is necessary that the Commission should know as soon as possible about the probable number of members of the Congress of 1900. They do not think, however, that they have the right to ask from anyone, so long in advance, a decided answer, but they particularly request that everyone will send them, as soon as possible, the postal card enclosed with the circular, after having stamped it and crossed out whichever one of the statements, as to probable attendance or non-attendance at the Congress it is desired by the sender not to make. This will not be considered to bind a person in any way to attend the Congress, but further communications will only be sent to those persons who have sent in the first reply by means of this postal card. All communications, except remittances, should be addressed to "M. Th. Vautier, President, 65 Rue de Provence, Paris."

The officers of the American Gas Light Association hope that the members will do all in their power to make this Congress a success; that as many as can arrange to do so will attend the meetings, and that those who are not able to attend will at least show their goodwill in the matter by subscribing for the report of "Proceedings," which should be fully worth its cost.

GEO. G. RAMSDELL, President.
ALFRED E. FORSTALL, Secretary.

THE semi-annual report of Mr. S. Ward, official gas inspector for Memphis, Tenn, for the period ended December 31, 1899, declares that "The gas has been free from sulphuretted hydrogen, and up to the ordinance in respect to good quality, with an average candle power of 20.1, and an average pressure of 1.95 inches."

AT the annual meeting of the Petersburg (Va.) Gas Light Company, the annual reports showed a satisfactory condition of the Company's affairs. The officers elected were: Directors, David Dunlop, Sr., John McGill, F. Whittle, John W. Bradbury and Nelson T. Patteson; President, John G. Dunn.

MR. JACOB BOOTH, who was prominent in the management of the Southbridge (Mass.) Gas and Electric Company, died in Jacksonville, Fla., some days ago. He was born in Woonsocket, R. I., September 8, 1836, and was well and widely known in the print cloth industry of the United States.

THE opposition concern at Peoria, Ills., known as the People's Gas and Electric Company, claims that it will be supplying gas there in a fortnight.

"W. J. S." is informed that at the annual meeting of the Syracuse (N. Y.) Gas Company the officers elected were: Directors, Stephen Peabody, W. L. Elkins, Jr., R. C. Pruyn, F. W. Barker, G. E. Warner, W. S. Andrews, J. J. Belden, A. K. Hiscock, W. B. Kirk, Jerome Cheney, Michael Whalen, F. J. Baker and A. C. Driscoll; President, Albert K. Hiscock; Vice-President, W. B. Kirk; Treasurer, Stephen Peabody; Secretary, F. W. Barker; Assistant Treasurer, J. J. Farrell. Replying further to his inquiry we may say that no reason exists just now for believing that anything will occur to prevent the consolidation of the gas and electric lighting interests of Syracuse, at the meeting called for such purpose, to be held next Wednesday.

AT the annual meeting of the Waltham (Mass.) Gas Light Company the Directors elected were: Arthur T. Lyman, A. M. Goodale, Augustus Flagg, C. H. Moulton, Henry N. Fisher and F. A. Stearns. Mr. Moulton succeeds Mr. Lowell Clark, who declined a re-election, and Mr. Stearns was chosen to succeed his father, the late Mr. George A. Stearns.

MR. R. I. MARK has been appointed Manager of the new Gas Company for Winston Salem, N. C.

MR. A. L. WOOLLEN, formerly at Ottumwa, Iowa, has been appointed Superintendent of the Fishkill and Matteawan Equitable Gas Company, of Fishkill-on-Hudson, N. Y.

THE proprietors of the Rochester (N. Y.) Gas and Electric Company have purchased the plant of the Genesee Paper Company, which is located on the west bank of the Genesee river a few hundred feet south of the lower falls and a few yards north of the middle falls, and will hereafter use the plant as a power station.

THE authorities of Dalton, Ga., have offered to purchase the plant of the Dalton Gas and Electric Light Company, for operation on municipal account, for the sum of $10,000. The owners of the Company ask $16,200 for its properties.

AT the annual meeting of the Portsmouth (N. H.) Gas, Electric, Light and Power Company the following officers were chosen: Directors, H. Fisher Eldredge, William W. Cotton, John M. Cheever, Calvin Page and Frederick M. Sise; President, H. F. Eldredge; Vice-President, William W. Cotton; Clerk and Treasurer, Hiram B. Lord; Supt. gas division, Thos. R. Martin; Supt. electric division, Albert Lee.

THE Bay County Electric Company, of Bay City, Mich., has sold its properties to the proprietors of the Bay City Gas Light Company.

AT the annual meeting of the Zanesville (Ohio) Gas Light Company the officers elected were: Directors, M. M. Granger, Alexander Grant, C. A. Abbott, Robert Fulton and Eugene Printz; President, M. M. Granger; Secretary, G. A. Allen; Superintendent, Eugene Printz; Asst. Supt., C. H. Printz.

THE proprietors of the Fitchburg (Mass.) Gas and Electric Company have put the gross selling rate at $1.80 per 1,000 cubic feet, with 20 cents off for prompt payment, within 20 days. The concession is to date from April 1st.

THE Gas and Electric Company, of Bergen County, N. J., seems determined to attract customers, if liberal treatment may be taken as an evidence of such determination. The latest offer of its proprietors which has to do with extending the use of gas on fuel account, is this:

"Our 1900 offer is that, if you will agree to use 6,000 cubic feet of gas in four consecutive months, we will give you a 4-burner gas range, set up and connected in your house, ready for use. The terms are that you are to pay us $3 before the range is installed, as an evidence of good faith, and all bills for gas consumed will be rendered as usual and must be settled on the usual terms. This $3 will be retained until the final settlement on the 6,000 cubic feet is made, when it will be credited on your account, and the range will become yours. In case the 6,000 cubic feet are not consumed at the end of the four months a bill for the balance will be presented at that time and must be paid before the range becomes your property. The range that we propose giving away is first class, guaranteed, and would cost you not less than $15, if bought from the dealer.

"*Special Offer.*—People do not give much thought to a gas range until the hot weather is here, and then everybody wants a range at once. The result is that we are misled, and a great many are obliged to wait. To avoid this rush again, and to facilitate our work, we make the following inducement:

"If you will give us your order at once and allow us to set your range at our convenience before May 1st, we will make the condition 5,000 cubic feet of gas, to be used in four consecutive months, instead of 6,000 cubic feet, as in our regular offer; in other words, a saving of over 15 per cent. The consumption of gas in this offer need not commence until May 1st. If you are not using gas at present, bear in mind that we supply service meter and, where necessary, a pipe from meter to range, all without cost to you. We will furnish you, free, a small two-burner cooking stove, if you wish to try it before accepting the range offer."

THE Burdett-Loomis-Pettibone Company is said to be estimating on the proposed works that are to be established in Knoxville, Tenn., under the auspices of the Tennessee Gas and Coke Company. The hyphenated concern, it is said, favors the Keneval process. It would seem to us that that process should be given a trial at Bridgeport, Conn.

MR. A. J. BYRNE, who was deputed to make an examination of the City Gas Works, of Alexandria, Va., by the Alexandria City Council, respecting the availability of the same for continued operation, has submitted the following report:

"The buildings for the storage of coal are of a substantial character, and the coal prepared at the time of my examination and ready for distillation was apparently of good quality. The retort and purifying house is, with one exception, in fair condition and can at small expense, when the benches of fives are renewed, be put in condition to last many years. The meter and valve building is in fair condition and can be made better by the expenditure of a few dollars. The engine room attached to retort house should be enlarged, built entirely of brick, and a photometer placed therein for the better observation of candle power of gas. Hydraulic main over benches of fives, levelled and supported so as to remain level and preserve uniform seal. Lids on all retorts should be self sealing. They save gas, time and annoyance; those now in use being many years out of date. Valves should be placed on stand pipes. All up-to-date gas works have these valves and also the improved self-sealing lids. A scrubber, for the better cleansing of the gas, should be added to the works, and the liquor sold, thereby producing a revenue to the city. The station meter has been in use many years and needs overhauling. The two gasholders are comparatively new and should, with proper care, last many years. They, I am informed, cost the city $14,000, and to duplicate them now would cost considerably over $20,000. In the retort house are 7 benches, containing 37 retorts; the two large benches of 6 retorts each are new and have not as yet been used. One of the remaining 5 benches has only been in use about 2 months; the remaining 4 benches were built about a year ago. They all appear to be in good condition and only need the improvements suggested above to produce better results. The purifying capacity is ample, and, with the addition of scrubber and change of purifying material, good gas can be furnished. The initial pressure is excessive, and the remedy can be found in removing all defective piping in mains, services and meters, which work can be gradually and effectively done by noting all complaints and attending to them promptly, thereby reducing the pressure and leakage which are twice as great as they should be. There should be a pressure register indicating and registering the pressure at all times both day and night. Consumers' meters should be tested every few years and kept in good condition, and a meter prover should be provided for this purpose—it is necessary for the above work. Mains not less than 4 inches and service pipes 1 inch should be used—the latter of black iron tested by steam and at the same time coated with tar. Improved tapping tools and machines should be provided; they save the loss of gas when tapping mains. There are about 8 or 9 tons of carbon at the works, the greater portion of which is the result of overcharging the retorts and imperfect distillation of the coal, which means a low yield and candle power—the light giving properties having solidified into carbon, the accumulation or removal of which shortens the life and often destroys the retort. The results, per man, do not justify the employment of the present force. From general reports I was led to believe the gas works were of little value, but on my examination I found all the buildings, with one exception, substantial and in fair condition. The gasholders, coal sheds, retorts, engine, purifiers, pipe and valve rooms and coke and lime sheds are in good condition, and with the improvements I have suggested added thereto the works would be all that could be desired at present. I see no reason for the appropriation by the City Council or the issuing of bonds by the city to raise money to improve the Alexandria gas plant. All needed improvements at the works and also the renewal of pipes in the city can be made gradually, and, I am sure, can be paid for out of the revenue derived from the gas office in a few years—provided a competent and experienced man is placed in charge of the gas works as superintendent."

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England—Aug. Siegle, 30 Lime Street, London.

MONDAY, FEB. 26, 1900.

The Market for Gas Securities.

Stagnation, with perhaps just a bit of manipulation, ruled in the city gas share market this week. The net result of the trading is a quotation for Consolidated to-day (Friday) at the close of the market of 188 to 189. The late rate of quarterly dividend (1 per cent.) was maintained. It was declared to day, and is payable the 15th prox. New Amsterdams show no variation from last week. Mutual is steady and Standards are strong. It is generally accepted that at the Consolidated special meeting, for March 9th, the proposition to exchange additional Consolidated stock for various electrical stocks will be ratified. There is, however, considerable disagreement between the majority and minority shareholders as to the wisdom of this step.

The weakness in Consolidated is inexplicable to outsiders, for every external indication, always remembering the Albany situation, goes to show that peace will be firmly established in New York City artificial lighting from central stations "on or about" May 1st.

Some weakness, in fact important weakness, was shown in Peoples, of Chicago, which is well under par. Trading and manipulation are the causes for the setback. The intrinsic value of the shares increases every day. Brooklyn Union is neglected, but it won't be for long. Bay State is as it was. The Columbus (Ohio) Company has virtually put its common stock at a parity with its preferred, an interim dividend of 2½ per cent. on the former having been declared.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEB. 26.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	188½	189
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	.
" 1st Con. 5's	2,300,000	1,000	115	18
Metropolitan Bonds	658,000	.	108	112
Mutual	3,500,000	100	2"5	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	.	
New Amsterdam Gas Co.	13,000,000	100	25½	26½
Preferred	10,000,000	100	46½	48
Bonds, 5's	11,000,000	1,000	97	97½
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000		115	..
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000		
Standard	5,000,000	100	115	125
Preferred	5,000,000	100	140	150
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,65	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	145	146
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1½	1¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works, .	450,000	100	40	..
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	..
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	72	75
Central, San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	108
Columbus (O.) Gas Lt. & Heating Co	1,682,780	100	60	65
Preferred	3,026,500	100	84	86
Consumers. Jersey City Bonds	600,000	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	193½	194½
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Consolidated, Baltimore	11,000,000	100	55	56
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	21	23
" Con. Mtg. 5's	380,000	1,000	87	90
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	95¼	96
" Prior Lien 5's	4,598,000	1,000	99¼	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	38	45
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	100	105
" Bonds, 6's	2 650,000	..	101	103
Jackson Gas Co	250,000	50	72	78
" 1st Mtg. 5's	250,000	1,000	101	102½
Lafayette Gas Co., Ind	1,000,000	100	40	45
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	106	
Laclede, St. Louis	7,500,000	100	74	79x
Preferred	2,500,000	100	98	101
Bonds	10,000,000	1,000	110	110½
Madison Gas & Elec. Co.	400,000	100	82	..
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	16,000,000	..	50	60
Bonds, 6's	4,600,000	..	107	108
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	43	45
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	97¼	97½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111⅜	111½x
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	49	50
St. Paul Gas Light Co.	1,500,000	100	57½	58½
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	88	90½
St. Joseph Gas Co	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	..	15
Bonds	1,612 000	1,000	85	90
Washington, D. C	2,600,000	20	268¾	270
First mortgage 6's	600,000	..	.	..
Western, Milwaukee	4,000,000	100	106¾	107¾
Bonds, 5's	3,830,500	.	106	108
Wilmington, Del.	600,000		220	50

Advertisers' Index.

GAS ENGINEERS.

	Page
Wm. Henry White, New York City	355
Fred. Bredel, Milwaukee, Wis.	342
Geo. R. Rowland, New York City	353
The Western Gas Construction Co., Fort Wayne, Ind.	360
Humphreys & Glasgow, New York City	353
American Gas Co., Phila., Pa.	342
David Leavitt Hough, New York City	352
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	339
Baxter & Young, Detroit, Mich.	352
United Gas Improvement Co., Phila., Pa	347
James T. Lynn, Detroit, Mich	352
A. E. Boardman, Brevard, N. C	352

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd's Sons, New York City	356
Continental Iron Works, Brooklyn, N. Y	354
Deily & Fowler, Phila., Pa	356
Kerr Murray Mfg. Co., Fort Wayne, Ind	352
Stacey Mfg. Co., Cincinnati, Ohio	355
Bartlett, Hayward & Co., Baltimore, Md	353
Davis and Farnum Mfg. Co., Waltham, Mass.	352
R. D. Wood & Co., Phila., Pa	354
Isbell-Porter Company, New York City	354
Fred. Bredel, Milwaukee, Wis.	342
United Gas Improvement Co., Phila., Pa	347
National Gas and Water Co., Chicago, Ills.	349
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	339
The Western Gas Construction Co., Fort Wayne, Ind.	360
Humphreys & Glasgow, New York City	353
American Gas Co., Phila., Pa.	342
Logan Iron Works, Brooklyn, N. Y.	356
Riter-Conley Mfg. Co., Pittsburgh, Pa.	355
Baxter & Young, Detroit, Mich.	352
Berlin Iron Bridge Co., East Berlin, Conn.	341
G. Shepard Page's Sons, New York City	352
James T. Lynn, Detroit, Mich.	352
A. E. Boardman, Brevard, N. C.	352
Sutherland Construction & Improvement Co., N.Y. City	340
Chris. Cunningham & Son, Brooklyn, N.Y.	327

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	353
United Gas Improvement Co., Phila., Pa.	347
Burdett Loomis, Hartford, Conn.	354
National Gas and Water Co., Chicago, Ills.	349
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	339
The Western Gas Construction Co., Fort Wayne, Ind.	360
Humphreys & Glasgow, New York City	353
Sutherland Construction & Improvement Co., N.Y. City	340
B. E. Chollar, St. Louis, Mo.	340

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa.	354
James R. Floyd's Sons, New York City	356
Continental Iron Works, Brooklyn, N. Y.	354
Logan Iron Works, Brooklyn, N. Y	356
Riter-Conley Mfg. Co., Pittsburgh, Pa.	355

TAR AND CARBONIC ACID EXTRACTOR.

R. D. Wood & Co., Phila., Pa.	354

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich..... 337
American Gas Company, Phila., Pa..... 342

GAS METERS.

John J. Griffin & Co., Phila., Pa..... 320
American Meter Co., New York and Philadelphia..... 359
Helme & McIlhenny, Phila., Pa..... 359
D. McDonald & Co., Albany, N.Y..... 357
Nathaniel Tufts Meter Co., Boston, Mass..... 358
Maryland Meter and Mfg. Co., Baltimore, Md..... 358
Metric Metal Co., Erie, Pa..... 359
Keystone Meter Co., Royersford, Pa..... 358
Detroit Meter Company, Detroit, Mich..... 359

PREPAYMENT METERS.

American Meter Co.. New York and Philadelphia..... 359
John J. Griffin & Co., Phila., Pa..... 320
D. McDonald & Co., Albany, N. Y..... 357
Helme & McIlhenny, Phila., Pa..... 359
Nathaniel Tufts Meter Co., Boston, Mass..... 358

GAS AND WATER PIPES.

M. J. Drummond & Co., New York City..... 357
R. D. Wood & Co., Phila., Pa..... 354
Warren Foundry and Machine Co., New York City..... 357
Donaldson Iron Co., Emaus, Pa..... 357
Chris. Cunningham & Son, Brooklyn, N.Y..... 338

PIPE CUTTERS.

The Anderson Pipe Cutter Co., East Boston, Mass..... 337

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City..... 339

GAS TAPPING MACHINES.

George Light, Dayton, O..... 336

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y..... 349

GAS COALS.

Penn Gas Coal Co., Phila., Pa..... 351
Perkins & Co., New York City..... 350
Despard Gas Coal Co., Baltimore, Md..... 351
Westmoreland Coal Co., Phila., Pa..... 351
Berwind-White Coal Mining Co., New York and Phila... 350

CANNEL COALS.

Perkins & Co., New York City..... 350

CONVEYORS.

The Link-Belt Machinery Co., Chicago, Ills..... 339

GAS ENRICHERS.

Standard Oil Co., New York City..... 351
The Sun Oil Co., Pittsburgh, Pa..... 351

COKE CRUSHER.

C. M. Keller, Columbus, Ind..... 351

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 341

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 350
Isbell-Porter Co., New York City..... 354
R. D. Wood & Co., Phila., Pa..... 354
Wm M. Crane Co., New York City..... 338

CEMENTS.

C. L. Gerould, Galesburg, Ills..... 348

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J..... 348
Adam Weber, New York City..... 348
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 348
Cyrus Borgner, Phila., Pa..... 348
James Gardner, Jr., Pittsburgh, Pa..... 348
Henry Maurer & Son, New York City..... 348
Baltimore Retort and Firebrick Co., Baltimore, Md..... 348
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 348
Brooklyn Firebrick Works, Brooklyn, N. Y..... 348

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md..... 353
Fred. Bredel, Milwaukee, Wis..... 342
J. H. Gautier & Co., Jersey City, N. J..... 348
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 348
Adam Weber, New York City..... 348

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City..... 354
Continental Iron Works, Brooklyn, N.Y..... 354
Logan Iron Works, Brooklyn, N. Y..... 356
R. D. Wood & Co., Phila., Pa..... 354

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa..... 346

BURNERS.

C. A. Gefrorer, Phila., Pa..... 354
Wm. M. Crane Co., New York City..... 339
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 339

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 339

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila..... 344
Thos. T. W. Miner, New York City..... 337

PURIFIERS.

Stacey Mfg. Co., Cincinnati, O..... 340

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 349

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y..... 341
Chapman Valve Manufacturing Co., Boston, Mass..... 341
R. D. Wood & Co., Phila., Pa..... 344
Continental Iron Works, Brooklyn, N. Y..... 344
The P. H. & F. M. Roots Co., Connersville, Ind..... 348
Isbell-Porter Co., New York City..... 354
The Western Gas Construction Co., Fort Wayne Ind.... 360

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind..... 348
Isbell-Porter Company, New York City..... 354
Connelly Iron Sponge and Governor Co., New York City 349

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 355

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City..... 357

PURIFIER SCREENS.

John Cabot, New York City..... 341

GAS STOVES.

American Meter Co., New York and Philadelphia..... 342
Maryland Meter and Manufacturing Co., Baltimore, Md. 358
Keystone Meter Co., Royersford, Pa..... 358
Wm. M. Crane Co., New York City..... 338
Nathaniel Tufts Meter Co., Boston Mass..... 358
National Stoves, Lorain, O..... 337
Abendroth Brothers, Port Chester, N. Y..... 337
Detroit Stove Works, Detroit, Mich..... 298

HOT WATER HEATERS.

Wm. M. Crane Co., New York City..... 338

GASHOLDER TANKS.

J P. Whittier, Brooklyn, N. Y..... 353

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 353
Continental Iron Works, Brooklyn, N. Y..... 354
Deily & Fowler, Philadelphia, Pa..... 356
Davis & Farnum Mfg. Co., Waltham, Mass..... 352
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 352
Stacey Mfg. Co., Cincinnati, Ohio..... 355
R. D. Wood & Co., Philadelphia, Pa..... 354
Logan Iron Works, Brooklyn, N. Y..... 356
Riter-Conley Mfg. Co.. Pittsburgh, Pa..... 355
Chris. Cunningham & Son, Brooklyn, N.Y..... 338

GAS SECURITIES.

Henry Marquand & Co., New York City..... 337

ADVERTISING.

J. Howland Harding, New York City..... 357

BOOKS, ETC.

Newbigging's Handbook..... 344
Field's Analysis, 1898..... 221
Scientific Books..... 350
Digest of Gas Cases..... 351
Practical Photometry..... 348
Gas Flow Computers..... 358
Hughes' "Gas Works"..... 349
Gas Engineer's Pocket-Book..... 220
Excerpts from Reports of Gas Commissioners..... 238
Poole on Fuels..... 319
Binders..... 357
Directory of Gas Companies..... 355
Practical Handbook on Gas Engines..... 344
Coal Tar Tree..... 340

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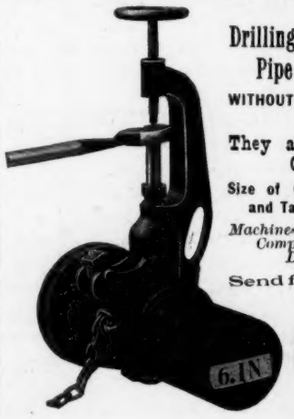

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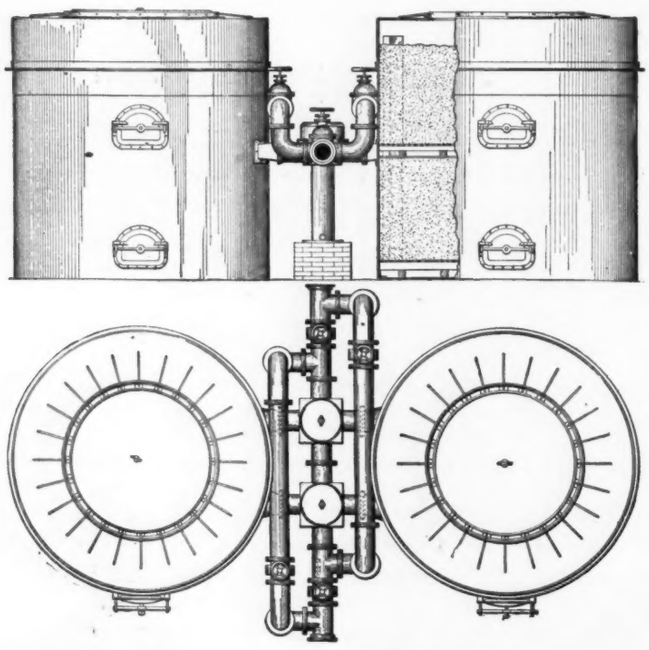

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BREDEL'S SYSTEM Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Charging and Discharging Machines, Etc.

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LATEST IMPROVED GAS EXHAUSTER

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NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
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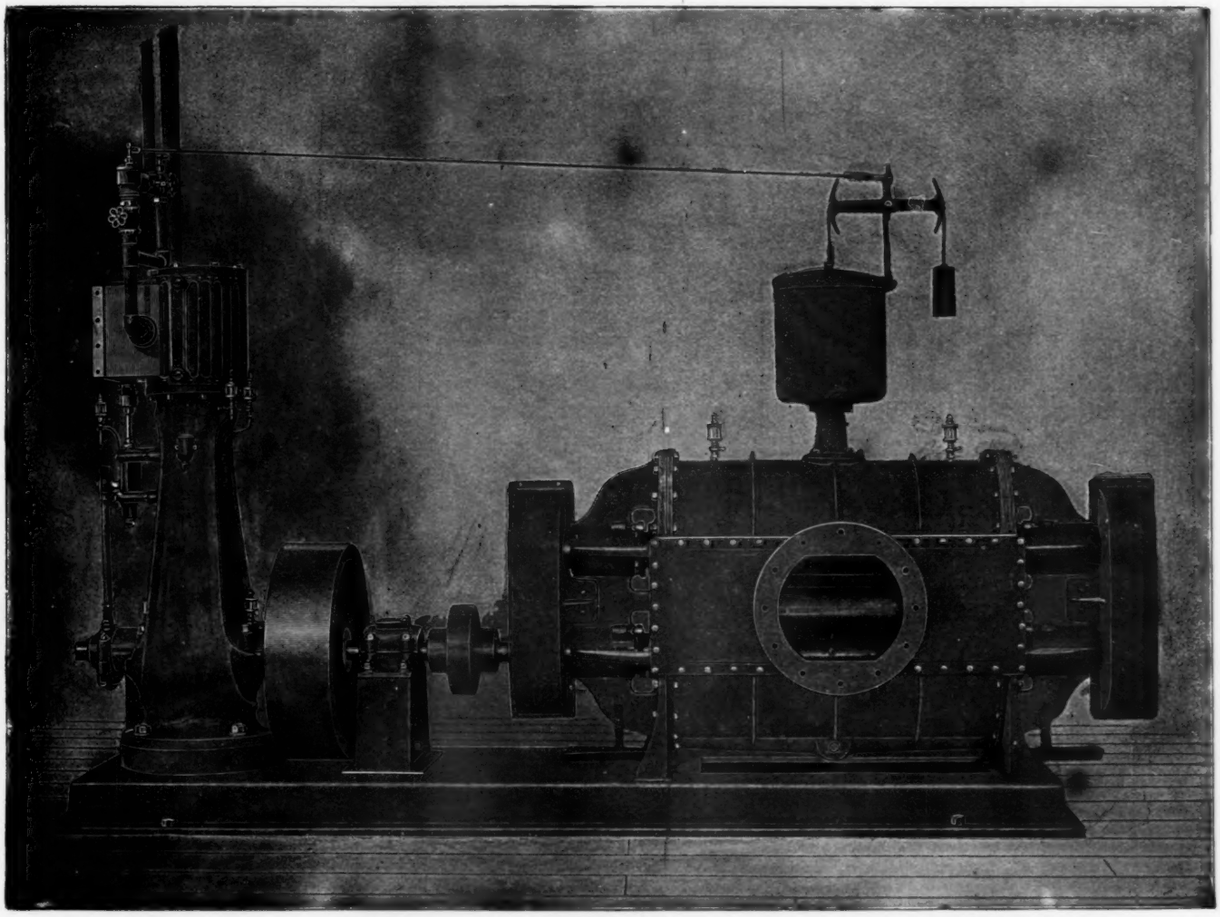

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.... OF AMERICA ....

No. 36.

Controls and Operates the

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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in seventy-five Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

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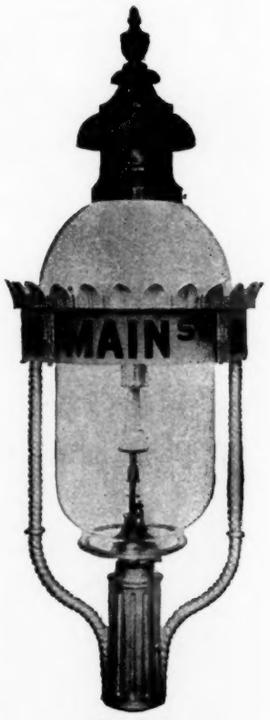
IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.



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With Instructions for Care and Working of the Same.

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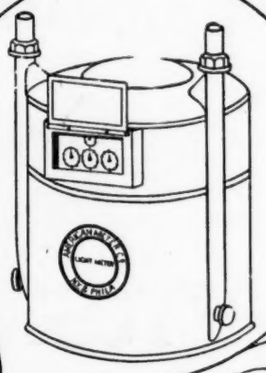
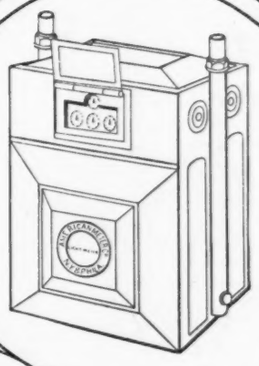
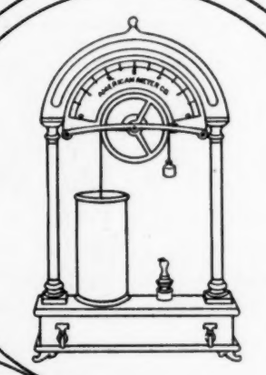


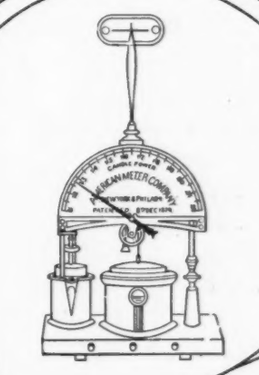


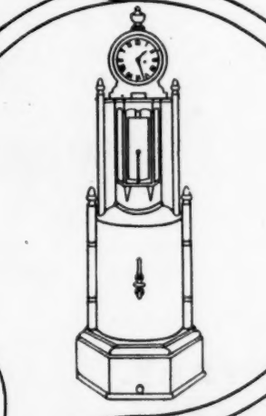
PUBLIC LIGHTING TABLE.

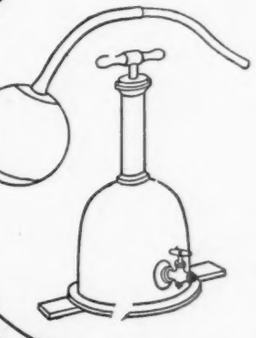
MARCH, 1900.

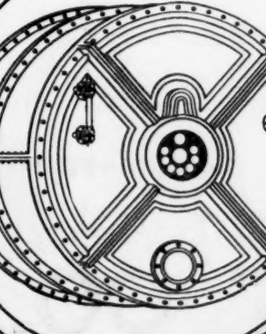
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. Extinguish.
				P.M.	A.M.
Thu.	1	6.20 PM	5.30 AM	5.30	5.45
Fri.	2	6.20	5.30	5.30	5.45
Sat.	3	6.20	5.30	5.30	5.45
Sun.	4	6.20	5.20	5.30	5.45
Mon.	5	10.20	5.20	5.40	5.35
Tue.	6	11.30	5.20	5.40	5.35
Wed.	7	12.30 AM FQ	5.20	5.40	5.35
Thu.	8	1.20	5.20	5.40	5.35
Fri.	9	2.00	5.20	5.40	5.35
Sat.	10	2.40	5.20	5.40	5.35
Sun.	11	3.10	5.10	5.40	5.35
Mon.	12	3.40	5.10	5.50	5.20
Tue.	13	4.00	5.10	5.50	5.20
Wed.	14	No L.	No L.	5.50	5.20
Thu.	15	No L. FM	No L.	5.50	5.20
Fri.	16	No L.	No L.	5.50	5.20
Sat.	17	6.40 PM	8.40 PM	5.50	5.20
Sun.	18	6.40	9.40	5.50	5.20
Mon.	19	6.40	10.40	6.00	5.10
Tue.	20	6.40	11.40	6.00	5.10
Wed.	21	6.40	12.40 AM	6.00	5.10
Thu.	22	6.40	1.40	6.00	5.10
Fri.	23	6.40 LQ	2.30	6.00	5.10
Sat.	24	6.40	3.10	6.00	5.10
Sun.	25	6.50	4.00	6.00	5.10
Mon.	26	6.50	4.30	6.10	4.55
Tue.	27	6.50	4.50	6.10	4.55
Wed.	28	6.50	4.50	6.10	4.55
Thu.	29	6.50	4.50	6.10	4.55
Fri.	30	6.50 NM	4.50	6.10	4.55
Sat.	31	6.50	4.50	6.10	4.55

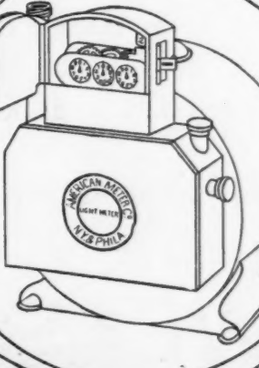












TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	230.50	January	423.20
February	175.40	February	355.25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152.00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr.	2221.40	Total, yr.	3987.45

THE RECENT DECISION.

The United States Circuit Court of Appeals,

In Its Opinion of December 7, 1899,

FINALLY AND FULLY SUSTAINS THE WELSBACH COMPANY'S PATENT.

DEALERS and USERS and MANUFACTURERS are CAUTIONED against INFRINGEMENT of the

Welsbach Patents.

Judge LACOMBE, in the United States Circuit Court, handed down the following opinion Saturday, Dec. 9, 1899.

On motion to restrain complainant from sending circulars to the customers of American Incandescent Lamp Company.

LACOMBE, Circuit Judge.

Irrespective entirely of the preliminary objection that affirmative relief of this sort will not be granted to defendant—a question not now passed upon—there seem no good grounds for criticism of complainant's circular. It states that Judge Townsend enjoined the "manufacture and sale" of infringing mantles, and he did grant such an injunction. And this Court has enjoined the sale of mantles which the person enjoined did not himself manufacture, when his past conduct in the matter of infringement created a special equity in favor of the complainant against him. It is true that the circular goes further, and threatens suit against persons who sell mantles, but who never have been at all concerned in manufacturing or causing them to be manufactured.

In other words, it threatens suit upon the patent as if it were a patent for a product. But the complainant insists that the threat is made in good faith; that it intends to bring suits against sellers of the infringing mantles upon the theory that the patent is really one for a product. In view of the peculiar language of the claim, this Court is not now prepared to hold that such contention would be wholly without merit, or that the complainant could not succeed against a mere seller. Moreover, it is contended that the seller of a purchased mantle himself promotes the taking of the final step in the process, and such contention has not yet been passed upon adversely to complainant. These are questions which should be left to be determined in one of such suits, rather than here. If complainant intends to prosecute one or more sellers, and there is nothing before the Court to induce a disbelief in its assertion that it does so intend, it would seem to be its proper course to warn dealers to desist from selling.

December 9, 1899.

Restraining orders issued in the United States Circuit Courts against—

THE UNITED INCANDESCENT LIGHT COMPANY.
ST. LOUIS INCANDESCENT MANTLE COMPANY.
ECKERLE ELECTRICAL COMPANY.
H. KUPFER.
THE NEWBY INCANDESCENT MANTLE COMPANY.

All infringers will be prosecuted, whether Manufacturers, Dealers or Users.

TO THE PUBLIC: Avoid Liability of infringement! Take nothing but the GENUINE always in sealed boxes bearing our registered trademark, "WELSBACH."

WELSBACH LIGHT CO.

Salesrooms in all the leading cities throughout the United States.

THE UNITED GAS IMPROVEMENT COMPANY.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Total Sets Installed to January 1, 1900, - - - - - - - - 327

Total Daily Capacity - - - - - - - - - 207,425,000 Cu. Ft.

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Established 1858. Incorporated 1890.
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Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

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We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

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Containing 6, 8 or 9 Retorts.

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A Guide to the Study of the Measurement of Light.

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Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by
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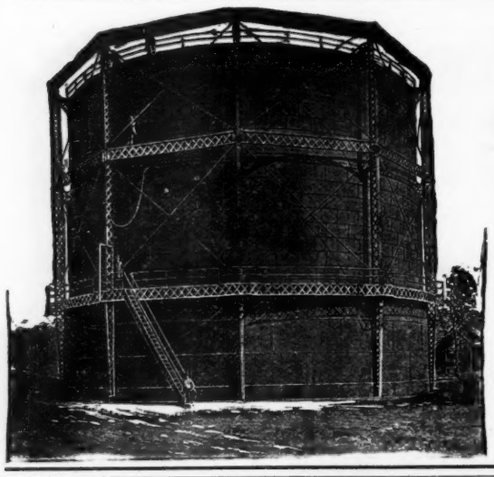

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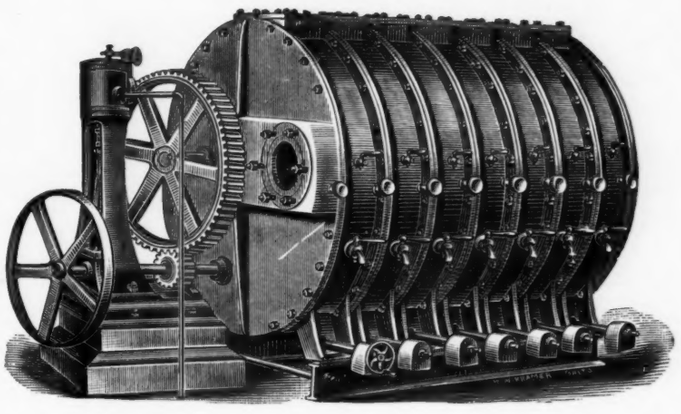

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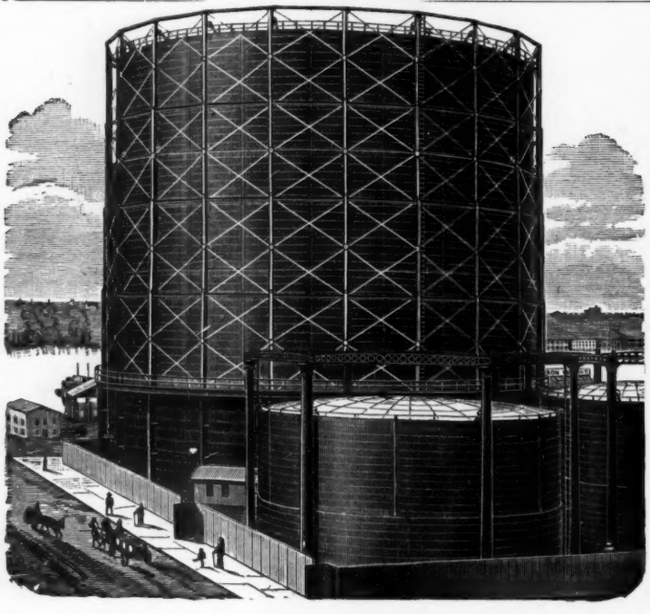

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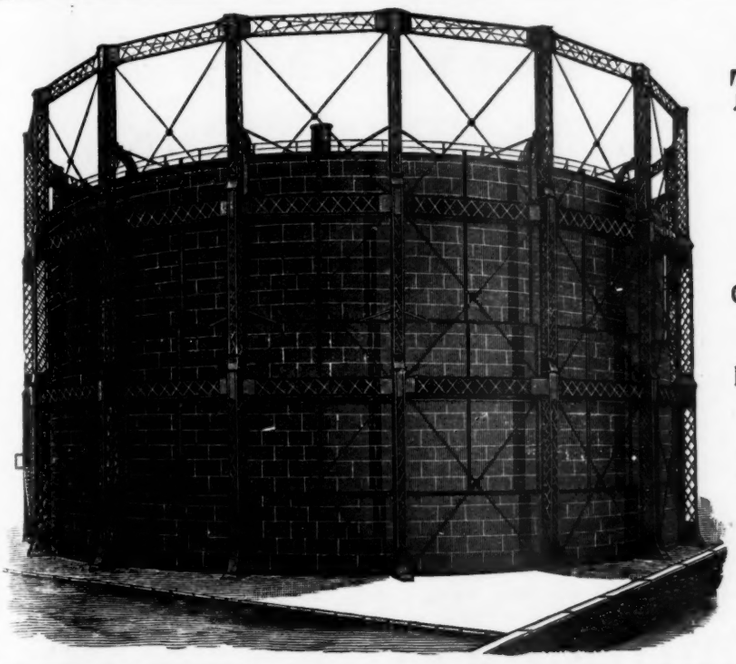

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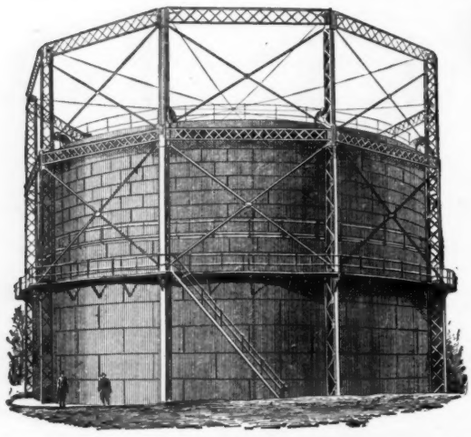

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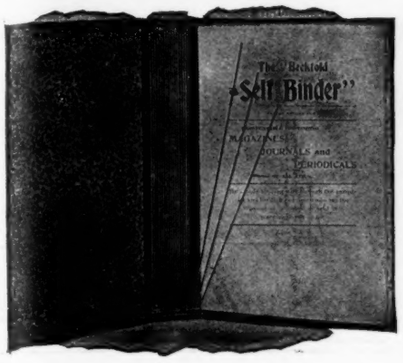

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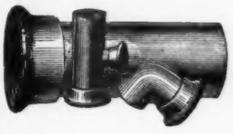

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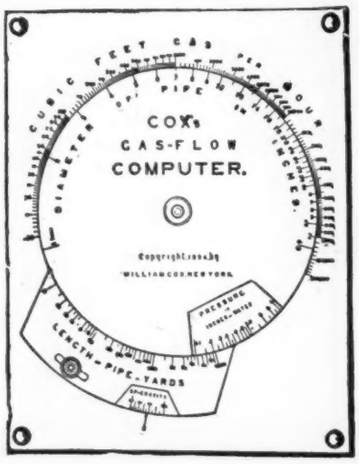

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